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CONTENTS

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IN THIS ISSUE

At the Fund's Eighteenth Annual Conference, the Round Table on Population Problems was devoted to the general question, Population Trends and Programs of Social Welfare. In this issue are published the first three of six papers presented at that meeting. The remaining three will appear in a later issue of the *Quarterly* and reprints of these articles will eventually be available in the form of a bound volume. The initial paper of the series was written by Dr. Warren S. Thompson and entitled "Outstanding Population Trends Affecting Problems of Social Welfare." In this introductory discussion Dr. Thompson presents some of the current estimates of the future trends in the size and age composition of our national population. Some of the data thus presented are used as points of departure in the succeeding papers devoted to specific aspects of social welfare.

In the second paper in the series, "Population Trends and Future Problems of Child Welfare," Miss Katharine F. Lenroot and Dr. Robert J. Myers discuss the implications for child welfare of situations such as the decline in aggregate number of children; regional, rural-urban, and class variations in rates of reproduction in relation to community services for children; numbers of children affected by broken homes due to mortality or separation of parents; and trends toward the small family pattern and gainful employment of urban mothers. The main thesis is that declines in aggregate number of children cannot justify curtailment in amount of total funds devoted to child welfare. This situation should rather be viewed as an opportunity to concentrate child welfare activities in regions and in elements of the population characterized at once by high fertility and low economic status. It is among these groups, particularly in certain rural sections, that diets, health facilities, and schools are poorest.

The subject of unequal educational opportunity is discussed more specifically by Dr. Newton Edwards in the third paper, "Population Trends

and Problems of Education." The author believes that current decline in the aggregate number of elementary school children should facilitate the financing of a more adequate and equitable educational program. The author presents the case for the partial national responsibility of this task. Although the schools tend to be poorest in areas characterized by highest birth rates, it is also true that ratios of school expenditures to income are conspicuously high in the poorest areas. Another reason advanced for national concern over this problem is that many people reared in poor rural areas migrate as young workers and become residents of distant cities.

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An important contribution to the epidemiology of tuberculosis has been made in the study "Mortality in the Children of Tuberculous Households" by Dr. Miriam Brailey of the Johns Hopkins School of Hygiene and Public Health. This paper presents an analysis of the risk of mortality in the children of 138 white and 147 colored families containing an adult with the diagnosis of pulmonary tuberculosis. Children in the colored families had a mortality three or four times greater than among children in the white families. The two groups of families were comparable in most respects and the difference in the risk of mortality suggests that the factor of race is important when a disease such as tuberculosis is considered. This article will be of special interest to those engaged in anti-tuberculosis activities.

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Recent studies have shown that differences in the fertility of various social, economic, and religious groups are due mainly to group differences in the prevalence and effectiveness of contraceptive practice and in the prevalence of induced abortion. The uncontrolled fertility of large groups of women varies little. There are, however, fairly wide individual differences and minor group differences in noncontraceptive pregnancy rates. In the paper entitled "Factors Underlying Individual and Group Differences in Uncontrolled Fertility," Regine K. Stix discusses some of the factors associated with these differences.

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Satisfactory evidence on the prevalence of malnutrition and of specific dietary deficiencies is much needed as a basis for sound, effective mea-

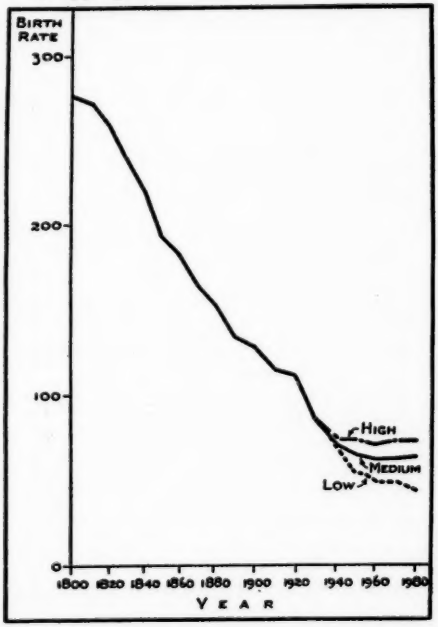
sures to raise the nutritional level of our population. However, present methods in general use for appraisal of nutritional status do not provide reliable information on the extent and nature of the nutrition problem. Chemical procedures and other diagnostic tests have been developed in recent years and these have great promise for a new medical approach to the problem of detecting nutritional deficiencies in apparently well persons, such as children attending school. In "Medical Evaluation of Nutritional Status" by H. D. Kruse, Carroll E. Palmer, William Schmidt, and Dorothy G. Wiehl, a cooperative investigation is described which is designed to appraise these newer techniques with reference to their suitability for survey and public health methods.

OUTSTANDING POPULATION TRENDS AFFECTING PROBLEMS OF SOCIAL WELFARE

WARREN S. THOMPSON[1]

THERE is little for me to do in opening this symposium on population trends and social welfare beyond summarizing the general population trends which all students of social problems recognize as having a more or less close connection with social welfare. I have nothing new to add to what is generally known. The only justification for this brief paper is that it may refresh your recollection of the main facts and may make it easier for those who follow to take some background information for granted and plunge at once into the discussion of the problems in which they are really interested.

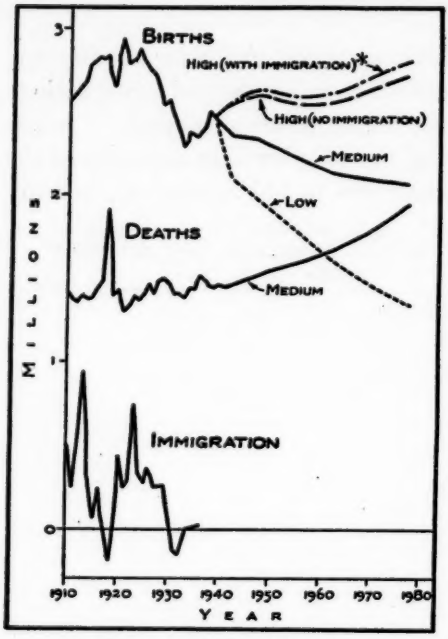
Fig. 1. White births per 1,000 women 15-44 in the United States, 1800-1930, and estimated for 1940-1980.



The population trends in which we are most interested here, stem chiefly from the declining birth rate, that is to say, the demographic changes now going on, which most directly af-

[1] Director, Scripps Foundation for Research in Population Problems, Miami University. This paper was presented at the Eighteenth Annual Conference of the Milbank Memorial Fund, April 2-3, 1940.

fect the welfare of the community, arise out of the small family system which is rapidly becoming general in this country. (Fig. 1.) It needs no extended argument to show that this is the case although it should not be forgotten that in the past both the growth and the composition of our population have been affected by immigration as well as by the rate of natural increase. (Fig. 2.)



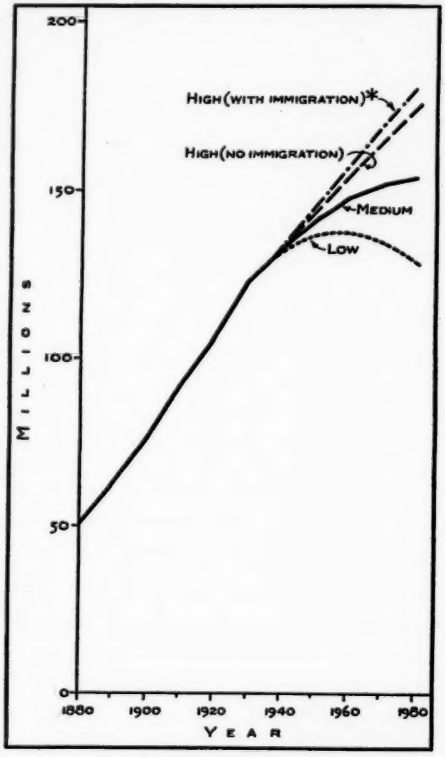
*Includes 100,000 immigrants annually.

Fig. 2. Annual births, deaths, and immigration in the United States, 1910-1980.

The two trends in the population which are of most immediate concern are: (a) the slower growth in numbers, with the consequent approach of a period of stationary or even of a declining population within the next two or three decades, and, (b) the change in the age make-up of our people.

In speaking of these trends as arising chiefly as the consequence of the declining birth rate, I have no intention of belittling the importance of immigration in contributing to the growth of our population in the past but from 1910-1930 it contributed less than one-fifth of this growth. Furthermore if the population in the United States in 1910 had had no decline in the birth rate between that time and 1930 there would have been slightly over four million more births than there were, and the population in 1930, without any immigra-

tion during this twenty-year period, would have been only a little over two million less than it actually was. The rapid decline in the rate of growth of population between the decade 1900-1910 and 1920-1930 took place in spite of a substantial net immigration. How the decline in the birth rate affects population growth will be still more obvious when the results of the 1940 census become available. Our rate of growth will be only a little more than half as great as in the preceding decade and the absolute growth will probably be the smallest since the decade of the Civil War.



*Includes 100,000 immigrants annually.

Fig. 3. Population of the United States, 1880-1930, with estimates to 1980.

It now appears that we shall not grow much, if any, beyond 152 or 153 millions before we begin to decline. (Fig. 3.) Assuming that this is the case I can see no serious limitations to greatly increased social welfare likely to arise from the pressure of population on resources during the next three or four decades. It will be the economic and social institutions we evolve to make use of our technical achievements and our great natural resources, which will determine our general level of living

rather than any limitation imposed by the ratio of numbers to resources. Nor, on the other hand, is there any reason to think that our population will be too small to defend itself in this troubled world. We can, therefore, lay aside any worries arising out of a too rapid or a too slow growth of population and turn our attention to changes in its composition as those which are most certain to affect its social welfare during the next generation or two. As said above, the chief of these changes in composition that will affect our welfare is that in age. These changes, like those in growth, are due basically to the declining birth rate, although for the next two or three decades the proportion of persons at the older ages will also show the effects of the large influx of immigrants in the decade preceding the first World War.

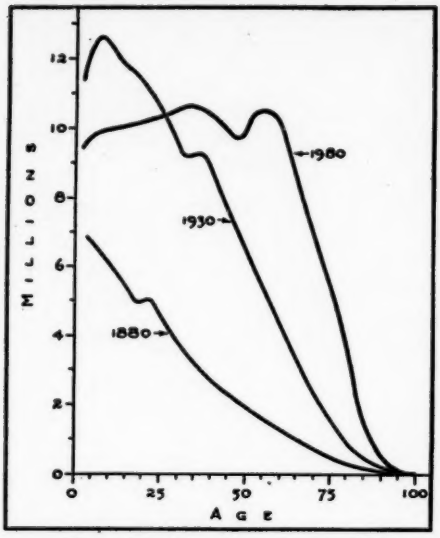


Fig. 4. Population by age in the United States, 1880 and 1930, and estimated for 1980.

The general effect of the age changes now in process will be to increase the proportion of older persons and to decrease the proportion of younger persons. (Fig. 4.) As a rapidly growing people we have always had a high proportion of children and young adults—much higher than in most countries. As the birth rate declines, however, the proportion in the younger ages declines (unless it is fully compensated for by a decline in the death rate at the younger ages) while those passing into the older age periods

are the survivors of a time when the birth rate was higher. Thus the proportion at the older ages will increase while the proportion at the younger ages will decline and the proportion in the more productive years (20 to 60), will not change a great deal for several decades. (*See* Table 1.) This is due to the fact that a marked falling off in the birth rate or, even in the number of births, such as that which began in 1926 in this country, does not begin to affect the young adult group until twenty years later. Furthermore, the large number of young adults, 20-29 years of age in 1930, who are the survivors of the children born from 1900 to 1910 will not begin to swell the groups above 65 until 1965 although some twenty years earlier, i.e., by 1945, they will begin to swell the middle-aged group.

Table 1. Per cent of population of United States in selected age periods, 1940-1980, medium estimate.

Age	Year				
	1940	1950	1960	1970	1980
	Per Cent				
TOTAL	100.0	100.0	100.0	100.0	100.0
Under 20	34.4	30.6	29.0	27.0	25.7
20-59	55.5	57.1	56.3	55.7	53.8
20-44	*38.9*	*39.9*	*37.5*	*35.1*	*33.8*
45-59	*16.6*	*17.2*	*18.8*	*20.6*	*20.0*
60 and Over	10.1	12.3	14.7	17.3	20.5

The length of time it takes the changes in the number of births to manifest themselves in the different age groups of the population explains the relatively slow rate of change to be expected in the productive group (20-64) as a whole. On the other hand, any decline in number of births or in birth rates affects the numbers or the proportion of the young population at once and is cumulative as long as the decline continues.

Since the death rates change relatively slowly in a population in which medical care and sanitation are already fairly good, it is not difficult to foretell with fair accuracy the number of survivors at any future date from the present population. But it is quite another matter to estimate the actual numbers entering the population either by birth or migration. There is reason to believe that the

birth rate will continue to fall, albeit more slowly than in the past, as long as there is any considerable part of the population which has not yet undertaken the voluntary control of births. (Fig. 1.) Our calculations of future population are based on this belief and the proportions in the several age periods are based on the assumption of a certain trend in births by age of mother as well as in deaths by age. It must be recognized, however, that the calculated future numbers in the several age periods, so long as they are based on persons already living, are more likely to be fairly accurate than the proportions at the several ages which may be altered by an increase or a decrease of the birth rate, assuming there is no immigration. At this time we have nothing to add to the calculations of population by age which we made several years ago.

No one is disposed to question the effects of the decline of the birth rate upon the size and the age composition of our population but the extent of these effects may be worth attending to for a few moments. In the year 1921 there were approximately 2.96 millions of births in the United States (allowing for nonregistration). With the death rates then prevailing this number of births annually would have maintained a stationary population of 169.7 millions, that is, we could have expected a population of this size in eighty to ninety years if there had been this many births each year and if the age specific death rates had not changed in the meantime. By 1930 the death rates had fallen to the point where these 2,960,000 births would have maintained a population of almost 180 millions—an increase of about ten millions over what they would have maintained had the 1919-1921 death rates continued to prevail. But there had also been a decline of about 500,000 births between 1921 and 1930 so that with 1930 death rates the 1930 births would only have maintained a population of 149.7 millions. In 1939 the number of births was slightly larger than in 1930 but with 1930 death rates the 1939 births would only maintain a population of 150.2 millions.

At the lowest death rates known to the writer, *viz.*, those of New

Zealand in 1931, our 1939 births would maintain a population of about 164 millions. There is no assurance that there will not be a further decline in the number of births nor is it likely that we shall soon attain as low death rates as New Zealand. At present I can offer nothing better than our estimate of about 152 or 153 millions which is likely to be attained sometime during the decade 1970-1980 after which a slow decline will set in. This assumes that immigration will be of little importance in the future.

The age composition of this population will be such that it will raise many problems affecting the general welfare of the nation. (Fig. 4.) There will be fewer children to each 100 adults of the ages 20-44 than there are now. The parental burden measured in dependent child units will grow lighter as the years go by. The ratio of children to the entire producing portion of the population will also decrease. I am not saying that the absolute burden of child care will grow less. This depends on the standards set as much as, or even more than, on the ratio of children to parents and to the producing population, but it does mean that with a small number of children the community will not need to invest such a large part of its annual income in children as in the past unless the investment per child increases at a more rapid rate than the proportion of children in the population declines.

On the other hand all the problems connected with the care of a dependent aged population will steadily become more urgent. In so far as the family shifts this burden to the community, as it is very rapidly doing, it means that there will be a larger and larger group of aged persons who will look to the community for support. This group will increase at an unusually high rate of speed for the next few decades because not only will the survivors of the high birth rate in the last quarter of the nineteenth century be passing into the old age groups but also a large portion of the immigrants who came to us before the first World War. The number of persons over 65 in our population will more than double between 1940 and 1970,

increasing from about 8.4 millions now to about eighteen millions in 1970, and the proportion will increase from about 6.3 per cent of the total population to about 11.9 per cent.

As said above, the proportion of the population in the productive ages will not change greatly in the next two or three decades. Furthermore, on any reasonable assumption of what constitutes a producing unit and a consuming unit in the population the ratio will become more favorable for another decade at least and will remain highly favorable until after 1970. This estimate makes due allowance for all age changes but it does not mean that the population within the broad age period 20-64 will remain essentially unchanged for the next thirty or forty years.

At the present time the younger part of this productive group is receiving very large annual increments, the largest it has ever received, and these increments will continue to increase in 1940 and 1941. After this they will be slightly smaller until 1946 after which time they will decline rather rapidly at least for a few years. But while these large numbers are entering the productive group there will also be large numbers entering the middle-aged group—45-64. The net result will be that whereas the 20-29 age group will lose about 3 per cent in the next forty years—declining from about 17.2 per cent to 14.2 per cent of the total population—the 45-64 group will gain about 5.4 per cent—rising from about 20.4 per cent to 25.8 per cent. Thus the problem of finding a satisfactory place for middle-aged workers in our population is going to become of increasing importance. In the ratios of productive to consuming units mentioned above it is assumed that men aged 45-64 have about 75 per cent of the productive capacity of those 20-44 but if some way is not found to maintain this productive capacity of middle-aged persons, it is clear that the ratio of productive units to consuming units will decline and this may very well mean a widespread lowering of the level of living. If this should happen it will, of course, introduce new public health problems just as changing age com-

position also brings new health problems. The maintenance of the productive capacity of the middle-aged is also in part an educational problem. But it is not my function to discuss these problems arising out of a slower growth of population and its changing age composition but rather, as said at the beginning, to give a rough and general background which will be filled in by others who are directly concerned with the problems raised by these changes in our population.

POPULATION TRENDS AND FUTURE PROBLEMS OF CHILD WELFARE

KATHARINE F. LENROOT[1] AND ROBERT J. MYERS[2]

THE research of population experts in recent years has thrown new light on the changing characteristics of our population, and permits us to anticipate future developments with considerable confidence. It is now predicted, for example, that the diminishing rate of population growth will reach the vanishing point within the next three or four decades. The proportion of old people in the population is increasing, and will continue to increase for many years. Significant differences in population trends, depending on geographical or racial factors or the extent of urbanization, indicate a continuation of the problem of migration. These and other developments are due in part to the small-family system which is rapidly becoming general in this country.

It is our present task to examine a number of these developments and to consider their significance in relation to the child population, their implications as to the aims of families and communities and of the Nation as a whole, for children. In approaching this subject we must bear in mind that the data in most cases are meager. The very useful compilation and analysis of available material in the report on "The Problems of a Changing Population" by the National Resources Committee has been used freely.

SOCIAL INTEREST IN CHILDREN, NOT POPULATION POLICY, OUR PRIMARY CONCERN

Unlike certain foreign countries which have adopted measures specifically designed to encourage large families, the United States

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has not been concerned about maintaining or increasing the birth rate. In fact, a considerable section of popular opinion tends to regard high birth rates in families of those with very limited economic resources or dependent upon relief as indicating a lack of responsibility for the welfare of their children or of consideration for the taxpayers who may be called upon to support them. Although legal barriers still tend to discourage the provision of facilities for the spread among the entire population of knowledge concerning methods of family limitation, the objections to contraception are based chiefly on religious considerations and not on population policy. There is probably nothing in our present outlook to indicate that the United States will soon consider policies directed especially toward the encouragement of large families as a means to population growth.

Regardless of the size of our population, however, we cannot afford to be indifferent to its quality. Moreover, we are, as a Nation, committed to social interest in the welfare of children, arising out of our conviction that every citizen in a democracy is entitled to opportunity for life, health, growth, education, constructive participation in community life, and social protection and assistance when needed. The White House Conference on Children in a Democracy has recently adopted, as part of its general report, recommendations which, if carried out, will lead us farther toward the realization of these aims of a democratic society for its children. By providing greater security and opportunity for children, we tend to reassure parents and somewhat to lessen the risks involved in bringing children into the world. Thus measures for promoting the health and well-being of children tend in some degree to constitute, indirectly, a population policy for the Nation.

Trends in Child Population

In the past twenty-five years the number of births per 1,000 population has declined by more than one-fourth, a decrease which has been compensated for only in part by a decline of approximately

50 per cent in infant mortality. Although the crude birth rates for 1937 and 1938 show slight increases, they undoubtedly reflect in part an increase in the completeness of birth registration. Further spread of contraceptive measures is to be expected, and the number of persons of marriageable age in the population will soon reach a peak and begin to diminish—factors which will result in a downward trend in the birth rate for some time to come.

A decrease in the number of children under 5 years of age was revealed by the census of 1930, but the 1940 census will be the first to record a decrease in the total child population. In 1930 there were in the United States approximately 48,300,000 children under 20 years of age. Today there are in the neighborhood of 46,000,000. By 1960 the number will probably be about 43,000,000.[3] Naturally changes in birth rates are progressive and not immediate in their effect upon age groups from infancy to maturity. Estimated by five-year intervals, the following are reasonable estimates of the trends from 1900 to 1980, assuming medium fertility and mortality[4] and no net immigration.

Age Groups	*Approximate Peak Year*	*Trend Following Peak*
Under 5 Years	1925	Decline to about 1935, slight rise to 1945, gradual decline thereafter.
5-9 Years	1930	Sharp decline to about 1940, slight rise to 1950, gradual decline thereafter.
10-14 Years	1935	Sharp decline to about 1945, slight rise to 1955, gradual decline after 1960.

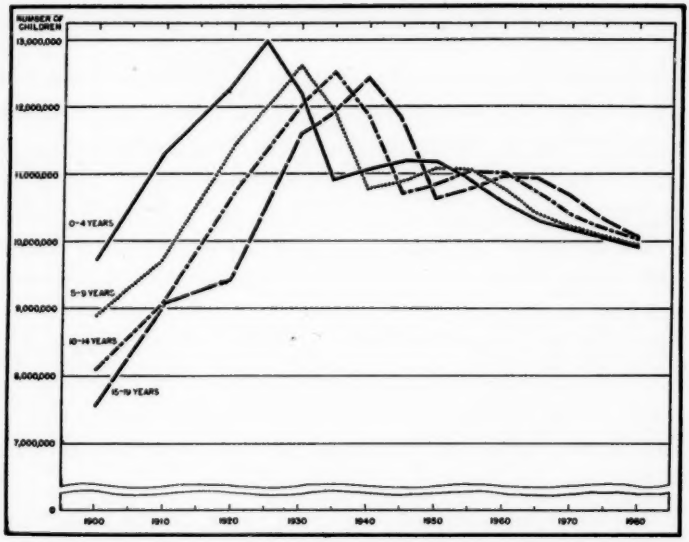
[3] National Resources Committee: THE PROBLEMS OF A CHANGING POPULATION, p. 25. Washington, 1938. (Estimates of future population were prepared for the Committee by the Scripps Foundation for Research in Population Problems.)

[4] Medium fertility assumes a continued but moderate decline in the fertility of native white females to 1980, and a 25 per cent reduction in the differences between their fertility and that of Negroes and other groups; medium mortality assumes a continued but moderate decline in mortality until in 1980 the life expectancy at birth for native whites is 70 years—also a 50 per cent reduction in the differences in mortality rates of native whites and other groups by 1980.

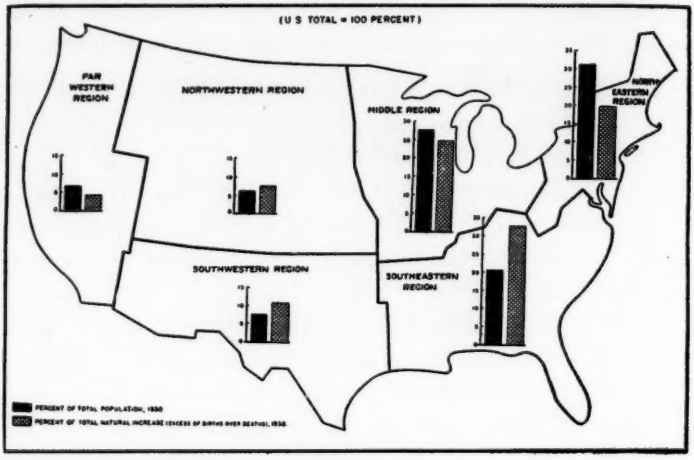
15-19 Years	1940	Sharp decline to 1950, slight rise to 1960, gradual decline after 1965.

According to these estimates, after 1965 the trend for all these age groups will be approximately the same, resulting in little change in relative numbers in the several age groups under 20. (Fig. 1.) To be of maximum value for social planning, these trends must be broken down by regions, states, urban and rural communities, economic status, and other headings. Wide regional variations are indicated by the fact that at present a large part of the natural increase is coming from the Southeast, the Southwest, and the Northwest. These three regions, which contain only about one-third of the total population, accounted in 1938 for 51 per cent of the excess of births over deaths, while the remaining regions, with two-thirds

Fig. 1. Estimated numbers of children in specified age groups, 1900-1980.



SOURCE: United States Census, 1900-1920, correction for underenumeration of children 0-4 years for 1900-1920, and estimate for 1925 made in the Children's Bureau, National Resources Committee, 1930-1980, assuming medium fertility and mortality and no net immigration.



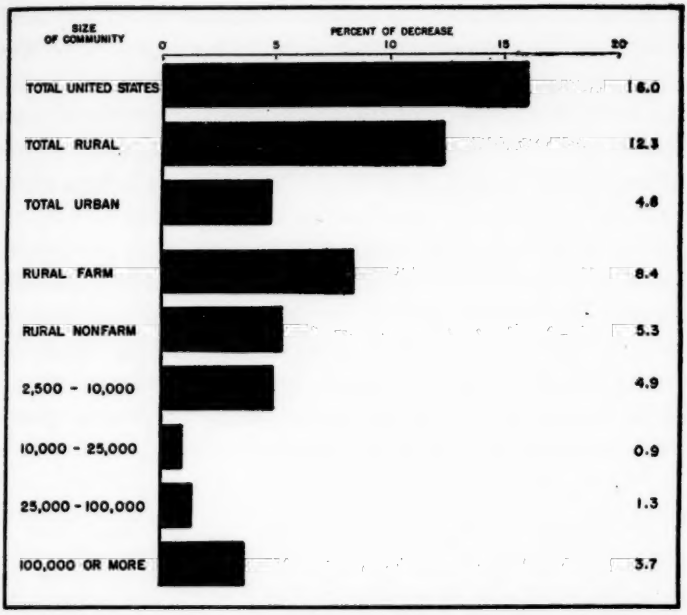
SOURCE: United States Bureau of the Census.

Fig. 2. Percentage of total population and percentage of total natural increase in each region.

of the population, accounted for only 49 per cent of the natural increase. (Fig. 2.) From 1930 to 1938 crude birth rates declined 15.4 per cent in the Northeast, 4.5 per cent in the Southeast, 6.9 per cent for the country as a whole, but increased 12.3 per cent in the far West. The great decrease in the Northeast undoubtedly reflects in part the rapidly declining fertility of the population of foreign stock. In the South the trend of fertility has been downward among both Negroes and whites.

Fertility[5] is generally higher in rural areas than in cities, and on farms than in rural nonfarm areas. In spite of the general movement of the population from country to city, reproduction rates are highest for farmers, and drop progressively as the size of the community increases. Fertility is particularly high in the poor, rural communities of the South. However, fertility has been decreasing more rapidly in rural areas than in urban, and among farmers than

[5] Fertility is here measured by number of children under 5 per 1,000 women 20 to 44 years of age.



NOTE: Based on changes in number of children under 5 per 1,000 women 20-44 years of age. Adjustments made for underenumeration and for other factors (see source). Separate figures for rural farm and rural nonfarm represent change only from 1920 to 1930. It was possible for the decrease in total fertility to exceed that in either urban or rural areas, because of the heavy migration from the rural to the urban areas.

SOURCE: National Resources Committee: THE PROBLEMS OF A CHANGING POPULATION, p. 127.

Fig. 3. Percentage decrease in fertility of native white women, by size of community, 1910-1930.

among nonfarm rural residents. (Fig. 3.) In general, only in the rural areas is fertility among Negroes higher than among whites. Childless families are particularly numerous among Negroes.

It is now a generally accepted fact that fertility tends to be highest among those groups whose economic and social status is least favorable. There is some indication, though inconclusive, that the disparity is more marked today than it was at the turn of the century. Between 1900 and 1930, for example, families of farm owners decreased slightly in size, but families of farm tenants and laborers

increased.[6] A comparison of county variations in fertility with county variations in plane of living reveals that in general fertility is highest in the areas where the plane of living is lowest. There is, also, an inverse relationship between size of family and cultural achievement. Married couples with little or no schooling have more children, on the average, than those who have gone to high school or college.[7]

Social planning for community services available to all children, regardless of economic status, must take into account probable trends in total child population in the several age groups in the particular areas or communities to which the planning relates. For health, housing, or social welfare programs which reach primarily those in the lower economic groups, population trends in the groups to be served must be separately estimated.

Population Trends and Family Life

Size of family is affected by both birth rates and death rates, as well as by other factors such as separation and divorce. Decrease in size of family has not been so great as has been popularly supposed. Census figures for 1930 are not comparable with those for earlier years but sample figures analyzed by Professor Ogburn indicate a decline of only 2.7 per cent from 1900 to 1930. Size of farm families actually increased by an estimated 3 per cent.[8]

The median family in 1930, according to the census, comprised 3.40 persons. Families are larger on farms (4.02) than in rural non-farm areas (3.28) or in cities (3.26). Native white families are smaller than those of foreign-born whites but larger than those of Negroes. Families in southern states are larger, on the average, than those in other regions. Unskilled workers, farmers, and farm labor-

[6] Ogburn, William F.: The Family and Its Functions. *See* Recent Social Trends in the United States, Vol. I, p. 686. New York, McGraw-Hill Book Company, Inc. 1935. (Preliminary findings from the National Health Survey, however, indicate that this movement may now have stopped or been reversed.)

[7] National Resources Committee: The Problems of a Changing Population, pp. 144-146. Washington, 1938.

[8] Recent Social Trends in the United States, Vol. I, p. 683.

ers have the largest families. Preliminary data from the National Health Survey for native white families indicate a substantially higher birth rate among families on relief or with low annual incomes than among families in the higher income brackets. It has been conservatively estimated that in a period such as 1935-1936 slightly more than one-half of all births occur in families receiving relief or with annual incomes under $1,000. Mortality rates, as well as birth rates, are high in low-income families.

Small families and the transfer of economic activities from home to industrial establishments mean that for many women homemaking and motherhood is not a full-time job, while the cash economy of family life makes it imperative for many mothers to become wage earners. These factors, together with the needs of children in one or two-child families for the stimulus and companionship of other children, lead to greater demands for nursery school and kindergarten and for community recreational facilities. Women must prepare themselves for gainful occupations as well as for homemaking and child rearing, and the community must supplement the facilities for child care and training in the home.

Between 1900 and 1930 the percentage of married women gainfully occupied increased from 6 per cent to 12 per cent, and material collected in connection with the 1937 unemployment census indicates marked increases in the number of gainful workers among women since 1930. At the same time, child labor has decreased greatly, due in part to changes in employment opportunities and skills and in part to restrictive legislation. Thus in cities and other nonfarm areas older children in the family, to a far greater extent than formerly, are not gainfully occupied.

It is estimated that in 1930, 2,718,000 of the 33,500,000 children under the age of 16 years—approximately 8 per cent—were orphaned; by the death of the mother (1,041,000), of the father (1,531,000), or of both parents (146,000). There were about 7,000 full orphans under the age of 5 years, 29,000 from 5 to 9 years, and

110,000 from 10 to 15 years of age.[9] Except among the young, remarriage rates are much higher for men than for women.

Although reduction in mortality rates has resulted in great gains in life expectancy, they affect chiefly the younger age groups. From 1900-02 to 1929-31, life expectancy at age 20 increased 3.3 years for white males and 4.2 for white females.[10] These moderate gains have been sufficient, however, to account for substantial reductions in the number of orphan children. Much of the decrease has been due to reduction in mortality from tuberculosis.[11] Future decrease from this cause will be much less. Maternal mortality has declined substantially only in recent years, but a decrease of 25 per cent from 1935 to 1938 is recorded. Further gains in life expectancy among persons of reproductive age can be expected as safety education, industrial hygiene, public health, and medical science advance in ability to prevent accidents and prevent and cure diseases of middle life. Particularly hopeful are the movement for control of syphilis and new methods of treating pneumonia.

The long-time trend in both marriage and divorce rates has been upward, but the divorce rate has risen faster than the marriage rate. In 1937 there were approximately 1,426,000 marriages and 250,000 divorces, or about one divorce for every six marriages—the all-time high for divorces. In part, the large number of divorces in 1937 represented an accumulation of divorces deferred during the depression years. It appears likely that the divorce rate will continue to increase for some years. Nation-wide data concerning desertion are not available. The illegitimacy rate appears to be rising slightly, but the increase is probably due in part at least to more complete reporting of illegitimate births.[12]

[9] Spiegelman, Mortimer: The Broken Family—Widowhood and Orphanhood. Annals of the American Academy of Political and Social Science, November, 1936, pp. 127, 123.

[10] Based on figures for Original Registration States.

[11] There were 31,000 fewer deaths from tuberculosis in 1938 than in 1928, and 60 per cent of this saving represents persons between 20 and 45 years of age.

[12] From 1930 to 1938 the proportion of illegitimate births to all live births rose from 3.5 per cent to 4.1 per cent.

The number of children under 16 in homes broken by divorce, separation, or desertion, and children in incomplete families because of illegitimacy has not been estimated. It appears from related census data, however, that in 1930 the number in homes broken by such causes probably did not exceed 1,000,000. From 1900 to 1930, according to the findings of Professor Ogburn,[13] among homes with children the decrease in the proportion broken by death slightly more than compensated for the increase in the proportion broken by divorce, separation, or desertion.

The importance of the death rate indicates that if mortality rates for persons of reproductive age can be markedly reduced, the proportion of broken families will decline even though divorce rates should continue to rise moderately.[14]

Population Trends and Community Services to Children

The White House Conference has recognized the fact that in a democracy responsibility for the care of children centers in the family. It asserted its belief that a free people "by conscious effort and thoughtful planning" can "make certain that the needs of all their children will be met." Although the Conference stressed the primary need for economic measures which will increase the ability of family breadwinners to earn a decent income on a normal, self-supporting basis, it recognized that measures are required also to supply substitute income where there is none or where it is insufficient to meet family needs, and to provide opportunities for children essential for their health and personal and social development.

In 1939 from six million to eight million children under the age of 16 years were in families dependent for food and shelter on various

[13] Recent Social Trends, Vol. I, p. 690.

[14] In 1930, according to special census reports, broken families with children under 21 included 89,000 whose head was a married man with wife not present, 389,000 headed by a widower, 30,000 headed by a divorced man, 115,000 headed by a single man, 241,000 headed by a married woman with husband not present, 1,055,000 headed by a widow, 130,000 headed by a divorced woman, and 66,000 headed by a single woman. The term "single person" does not necessarily signify an unmarried parent, but means someone other than a parent acting as the head of a family.

forms of economic aid, frequently grossly insufficient in amount. Probably at least ten million other children were in families with annual incomes under $1,000. In view of the high birth rates in low-income groups and the present inadequacy of programs of economic assistance to reach all children in need or to afford to all receiving aid the amounts required to provide for minimum necessities, even a marked rise in the index of employment, together with a decline in total child population, would not reduce the amount of aid under that now given to families with children unless many in urgent need were to remain uncared for or inadequately cared for.

We may hope for a further reduction in the number of broken families if medical science and public health are allowed to make reasonable progress both in research and in the extension of facilities for public health work and medical care. Although data are lacking on the basis of which any but the most general predictions can be made as to the probable need for economic aid for children in broken homes, it can be said with assurance that an early reduction in numbers of children in such homes receiving aid cannot be expected. We know that in 1930 approximately two and a half million children under 16 had lost one parent through death. Hundreds of thousands of children are in homes broken by divorce or separation, including desertion. On the basis of income distribution of the entire population at least half of these children in broken homes are in families whose income is below $1,000 a year, and many are in families with much smaller incomes. About 700,000 children are receiving assistance under the aid-to-dependent children provisions of the Social Security Act. It is estimated that within a few years an equal number will receive benefits under the recent old age and survivors' insurance amendments to that Act. The number of children in broken homes now receiving aid through WPA and general relief programs is not known.

The number of children in the population who have lost both

parents through death, on the basis of 1930 figures, is approximately 146,000. In 1933 approximately 250,000 children were in institutions for the care of dependent children or in foster family homes. Only approximately 22,000 of these were full orphans. A considerable number of full orphans will in time receive benefits under the old age and survivors' benefits provisions of the Social Security Act, and those who can be provided for with relatives are eligible for aid under the aid-to-dependent children provisions. Figures for urban areas reporting social statistics to the Children's Bureau show that since 1930 the number of children in institutions has decreased and the number of children in foster family homes has increased. However, there has been little change in the total receiving foster care in institutions or family homes. Decreasing numbers of children, especially those in the lower age groups in the population, and extension of economic aid for children in their own homes will necessitate in some areas modification and adaptation of child-caring programs and facilities. Care must be taken, however, not to apply general trends for the entire country to particular areas. Many communities are under-supplied with facilities for foster family care and for certain types of institutional care.

Decrease in child population during the next two or three decades has little more than academic importance as applied to planning for maternal and child-health services and social services for children in their own homes suffering from special handicaps, physical, mental, or social, as efforts to provide these services on a nation-wide scale are still only in their infancy. The White House Conference reported grave deficiencies in individual medical care, paralleled by lack of hospitals and clinics, and of public health nursing service, despite progress made during the last decade. Although great gains in providing social service have also been made during the last ten years, only a small proportion of the rural counties of the United States have child welfare workers. In most urban areas social services for children in their own homes, carried on by public and

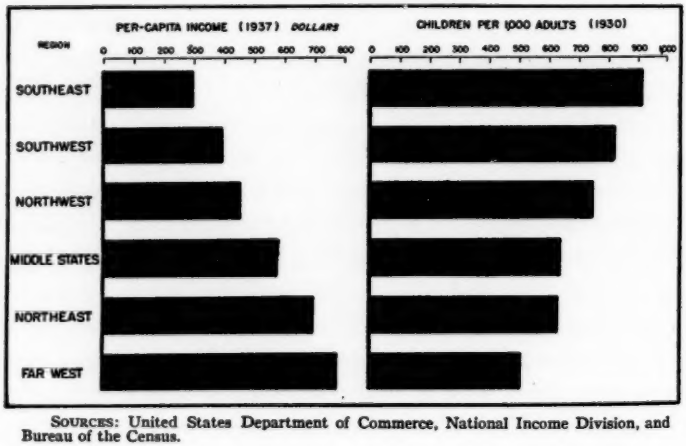
by private agencies, are in need of marked expansion, as well as reorganization and adaptation.

Although the number of youth 15 to 19 years is now near its peak, according to reliable estimates, and will hereafter decline sharply, changes in economic organization, occupational skills, and employment opportunities will make the needs of this group of outstanding importance during the next decade and thereafter. In no other age group is the need for social invention, for ingenuity and resourcefulness in meeting health, educational, vocational, and recreational needs so great.

Population Trends in Relation to State and National Planning for Children

As size of family is important in relation to economic capacity to provide for the wants of its members, so the ratio of children to adults in communities and States has an important bearing upon ability to support the necessary services for health, education, recreation, and social assistance and protection. When a high ratio of

Fig. 4. Per capita income and ratio of children under 20 to adults 20-64, by region.



Sources: United States Department of Commerce, National Income Division, and Bureau of the Census.

children to adults is associated with low per capita income, the result for the community or State may be compared with the effect on the family of association of high fertility with low family income, previously discussed.

The accompanying chart (Fig. 4) shows, for the various geographic regions, the average income per capita as of 1937 and the ratio of the child population (under 20 years) to the population aged 20 to 64. The figures are as follows:

Region	*Per Capita Income*	*Number of Children per 1,000 Population Aged 20 to 64*
United States	$547	696
Southeast	295	913
Southwest	395	820
Northwest	453	748
Middle	577	637
Northeast	697	630
Far West	766	506

Average income per capita tends to be consistently higher in those regions with smaller proportions of children, and lower in those regions with larger proportions of children. A large proportion of children naturally operates to reduce per capita income. The tax resources available in regions of high child population are proportionately much less than the resources available in regions of low child population.

The Southeastern region, it is estimated, has 11.6 per cent of the national income and 24.5 per cent of the children under 20. The Northeast region has 40 per cent of the national income and 29.5 per cent of the children under 20.

Within states, also high proportions of children are usually associated with low per capita income. This is due largely to urban-rural differences. The average income of farm families, after allowance has been made for the value of home-consumed produce, is far be-

low the average of the Nation. It is in the share-cropping areas of the South, the sub-marginal mining communities throughout the country, the drought areas, the cut-over regions, and other rural problem areas that the worst conditions are found.

Migration, which increased greatly during depression years, accentuates discrepancies between child population and ability to support community services, as well as creating special problems because of the difficulties involved in absorbing migrant families into community life. It is estimated that about a third of a million agricultural migrant families, comprising about a million persons, are in interstate migration, and many thousands of others are migrating within states. More than half the area of the United States is involved in this migration. A study of 6,655 migrant families in California showed that nearly two-thirds of the children were in families of five or more persons, and that 35 per cent of the individuals in the families studied were under the age of 15 years.[15]

The surplus of births in many rural areas, and the failure of city populations to reproduce themselves, induce a flow of migration from farm to city. Farm families and farm communities bear the cost of rearing a considerable proportion of those who, as they attain maturity, constitute the population of urban communities. The extent to which they are prepared for self-support, for family and community life, and for discharge of civic responsibilities is therefore of great concern to city residents as well as to the communities in which they are brought up. Special needs for guidance and preparation for city life created by migration from country to city are as yet, for the most part, unmet.

The White House Conference recommended that the Federal Government assume special financial and planning responsibility for interstate migrants, and that to meet unequal capacities of state and local governments, national and state grants in aid for the

[15] A Study of 6,655 Migrant Households in California, 1938. Washington, United States Department of Agriculture, Farm Security Administration. 1939.

support and expansion of certain services to children should be extended. By such grants it pointed out that a reasonable minimum may be provided and inequalities may be removed so far as possible by spreading the cost. Federal grants on a matching basis do not fully equalize either support or service. "It is clear," the White House Conference reported, "that more recognition must be given than at present to apportionment by Federal and State governments on the basis of the needs and resources of the States and of the localities within the States."

POPULATION TRENDS AND PROBLEMS OF EDUCATION

NEWTON EDWARDS[1]

THE decrease in the absolute number of young people of school and college age, the change in the age structure of the population, and differential rates of reproduction all give rise to educational problems of varying degrees of importance. Problems growing out of the first two of these aspects of population change appear to be easier of solution and of less real significance than those which spring from differential fertility. For that reason I shall treat them rather briefly.

The declining importance of children and youth as a population element, both absolutely and relatively, may be expected to affect rather definitely school and college attendance, the amount and kind of schooling afforded in most communities, the structural organization of the educational system, and the ease with which educational programs can be supported. One may speak with some assurance with respect to attendance at the elementary school. There are today about one and one-half million fewer children of elementary school age than ten years ago. Already elementary school enrollments are beginning to drop. During the six-year period ending in 1936, enrollments in the elementary grades decreased in thirty-six states, the total decrease amounting to 886,032, or 4.2 per cent.

Future trends with respect to high school attendance are more uncertain. It is clear, however, that the period of phenomenal expansion is drawing to a close. Whelpton estimates that the number of youth of high school age will reach a peak in 1940 and thereafter decrease irregularly until 1980. With the population of high school age actually decreasing in size and with more than 65 per cent of

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This paper was presented at the Eighteenth Annual Conference of the Milbank Memorial Fund, April 2-3, 1940.

this age group already attending school, it will be impossible, as in the past, to double high school enrollments each succeeding decade. This situation should prove advantageous. In a period of unprecedented popularization of education such as has characterized the United States for several decades, emphasis has necessarily been placed upon quantitative considerations; for the past half century the task of doubling the facilities for secondary education almost every decade has taxed heavily both the financial and intellectual resources of most communities. But in the future, as the burden at the elementary level grows lighter and as the rate of increase in high school enrollments falls off, it should be possible to improve standards, to staff the schools with better-qualified teachers, to organize more effectively the content of instruction, and to extend opportunity for a junior college education. Population trends may be expected to have a definitely favorable effect upon extension of the secondary school upward to include the junior college.

Within a very few years the absolute number of young people in the college age group will begin to decline. Obviously, if college enrollment is to increase or even remain stable, the colleges will have to attract a larger percentage of the college age class. Apparently, colleges, considered as a whole, face the prospect of a declining enrollment unless they become somewhat less selective or find funds with which to subsidize poor but capable students. A policy of subsidizing poor but capable students has much in its favor in view of the fact that the pattern of income distribution tends to fix a ceiling to college attendance. In this connection it may not be amiss to point out that a large percentage of the intellectually superior youth of the nation are not attending college.

In the past, the changing age composition of the population has operated to make it easier to support programs of education and child welfare, and Dr. Thompson's figures indicate that it will operate in the same general direction for at least another thirty years. As the ratio of children and youth to productive workers

declines and this gain is not wiped out entirely by an increasing number of old dependents, it should be possible to finance a more adequate educational program with no increased demand on the social income. In the working out of an enriched and improved program problems will be encountered with respect to such matters as teacher education and tenure, curriculum reorientation, district reorganization, building design and location, financial aid to worthy youth, and adult education. The increasing proportion of adults in the total population together with other social trends suggests the desirability of making adult education an integral part of the program of public education.

Regional, community, and class differentials in reproduction give rise to educational problems of more serious import. They make it extremely difficult to realize the American ideal of reasonably equal educational opportunity for all, they promote the spread of an inferior cultural heritage and thereby tend to cancel out the benefits that accrue from our entire educational enterprise, they tend to create an intense pressure of population on the resource structure in certain areas and in doing so give rise to problems of internal migration and education nation-wide in their significance. And some entertain the suspicion that differential fertility is operating to lower the innate mental ability of the American people. Perhaps it would be well to examine briefly some of the evidence supporting these broad generalizations.

The wide differentials in the fertility among women in the various states and regions and in communities of different size result in a striking imbalance in the distribution of the burden of child care and education. The economically productive age group (20 to 64) in the Southeast carries a burden of child support and education, at the elementary school level, 80 per cent greater than that carried by the productive workers of the Far West, and about 44 per cent greater than that carried by the same age group in the Northeast and Middle States.

Differences in the ratios of children to adults are, of course, much greater when individual states are compared. For example, the number of children 5 to 17 years of age per one thousand adults 20 to 64 years of age, for a selected number of states, is as follows: South Carolina, 739; North Carolina, 691; Alabama, 628; and Utah, 612. For another selected group of states the ratios are: Ohio, 418; Massachusetts, 404; Illinois, 389; New York, 363; and California, 319. Incidentally, the high ratios of children to adults in the southern states are not generally due to a high fertility among Negro women.

Differences in the distribution of the population of school age in relation to the supporting adult group are even more striking when communities of different size are compared. In every part of the United States, the educational load, as measured by the ratio of children to adults, rests relatively light on the urban dweller. In rural nonfarm communities, the relative number of children is markedly greater than in the larger cities. It is, however, the rural-farm population that is carrying a burden of young dependents out of all proportion to that carried by the population in other types of communities. Each thousand adults in the rural-farm population of the Southeast and Southwest is carrying a burden of child nurture and education more than twice as great as that carried by a similar number of adults in the larger cities in those sections, and in other regions the educational load of the rural-farm population ranges from 62 to 85 per cent greater than in the larger cities. It is also true that in rural communities, both farm and nonfarm, the ratios of persons 65 years of age and over to the productive age class are higher than in urban communities.

The unequal distribution of the educational load takes on special significance when considered in relation to differences in planes of living, economic capacity, and cultural resources. By making use of the index of planes of living data employed by Carter Goodrich and his associates in their Study of Population Redistribution[2] we

[2] Goodrich, Carter and Others: MIGRATION AND ECONOMIC OPPORTUNITY. Philadelphia, University of Pennsylvania Press. 1936. 780 pp. $5.00.

were able to prepare two maps, one showing for each county in the United States the plane of living, and the other showing for each county the ratio of children of elementary school age to the economically productive adult population. With relatively few exceptions, counties having a high plane of living have a low ratio of children to adults. In contrast, areas with a low plane of living, as measured by this index, are carrying a disproportionately heavy burden of child nurture and education. The educational load in many of the low-plane-of-living areas is fully twice that of many high-plane-of-living areas.

A comparison of the distribution of children of school age and of income among the various states and regions discloses similar differences and irregularities. In 1930, the Northeastern area had in it 30 per cent of the Nation's children of school age, but in dividing up the Nation's income it received 43 per cent of the total. The Southeast, in contrast, had 24 per cent of the children, but its share of the national income was only 10 per cent. It is, however, the farm population that is carrying the heaviest load of child nurture and education with the least economic ability. In 1930, farmers had the responsibility for the care and education of 31 per cent of the Nation's children, but farmers received only 9 per cent of the estimated national income (1929). For every dollar of estimated income behind the education of the farm child there was $4.44 behind the education of the nonfarm child. The farm population of the Southeast had 13 per cent of the Nation's children of school age but it received only 2 per cent of the national income. In contrast, the nonfarm population of the Northeast had 27 per cent of the children but its share of the national income was 42 per cent.

Other indexes of planes of living and of educational and cultural status tell a similar story of geographical differences and distinctions. In general, in those areas where fertility is the highest and where the educational load is the heaviest, educational opportunity is the most restricted, the ratios of physicians, nurses, and dentists to

each 10,000 of the population are relatively low, library facilities are more limited than in other parts of the country, and the circulation of daily newspapers and nationally-known magazines falls far below the national average.

When all the data are brought into focus we get a picture something like this: in communities where fertility is below what is required for family replacement, where the burden of child care and education is relatively light, where planes of living are high, where economic resources are most abundant, and where the cultural-intellectual status of parents is high, we support education relatively well and with comparative ease. In communities where the birth rate is high and the economically productive adult group is carrying a disproportionately heavy child population, where income per child is far below the national norm, where the plane of living is low, where the cultural heritage is the poorest, and where the home has least to contribute to cultural and intellectual growth we support education inadequately although with unusual effort.

Education can be made a force to equalize the condition of men; it is no less true that it can be a force to create class, race, and sectional distinctions. We may well take heed of the direction in which our present policies are carrying us. If, for a long period of years, we draw each succeeding generation in disproportionately large numbers from those areas in which economic conditions are poorest and the cultural-intellectual level the lowest, if the population reserves of the nation are to be recruited from a definitely underprivileged class, and if we fail to make good the deficit by conscious educative endeavor, the effect on our culture and even on our representative political institutions may be far different from what is desired.

I can mention only briefly certain educational problems which grow out of the problems of population redistribution. Since agriculture faces a long-time trend of diminishing employment capacity and since natural increase is still relatively great in the farm popula-

tion, farm boys and girls may be expected to turn cityward in an effort to pry open the doors of employment and social opportunity. Cities will probably draw off in considerable volume the redundant population from the Southern Appalachians, the Old Cotton Belt of the Southeast, the Great Plains, and from marginal and submarginal agricultural areas elsewhere. Certainly the rural school should attempt to give some intelligent direction to this rural-urban migration.

And rural-urban migration is tied in with the whole problem of occupational mobility in general. Unskilled and semi-skilled laborers are the only urban groups of numerical importance that are replacing themselves. The relatively high fertility of certain urban occupational groups creates a pressure of population in these occupations not unlike the pressure on agriculture resulting from a high birth rate among farmers. The school has always been regarded as an instrument of social mobility and it can scarcely side-step the responsibility of directing the occupational distribution of both rural and urban youth.

The close association of high fertility, low planes of living, restricted income, and low cultural-intellectual status with poor educational facilities points unmistakably towards a reshaping of our national educational policy. If the American educational system is to be truly democratic, if it is to prove adequate in serving the national interest, some way must be found to enable those states and communities in which the burden of child care is the greatest and in which economic resources are the most restricted to provide for their children a fuller and richer educational program.

The problem of unequal educational opportunity is essentially a rural problem. Education along with other agencies faces the immense task of reintegrating rural life with our national culture and education cannot perform its part of the task without additional Federal and state aid.

It was suggested earlier that differential fertility tends to cancel

out the gains that accrue from our entire educational enterprise. If this is true and if one of the main purposes of education is to improve the quality of a population, our schools and colleges might well adopt a policy of developing in youth, and in adults as well, attitudes toward family life and toward the bearing of children which will tend to lift the physical and intellectual quality of the future population.

MORTALITY IN THE CHILDREN OF TUBERCULOUS HOUSEHOLDS[1, 2]

MIRIAM BRAILEY, M.D.

IT is the purpose of this paper to present an analysis of the risk of mortality in the children of families containing an adult with the diagnosis of pulmonary tuberculosis.

The records for analysis are those of an out-patient clinic for childhood tuberculosis conducted since 1928 at the Harriet Lane Home of the Johns Hopkins Hospital. The clinic admits only infants under 2 years of age; and they must be tuberculin-positive or, if tuberculin-negative, in household contact with an adult known to have pulmonary tuberculosis. Once a patient is registered, he is kept under medical supervision as long as possible.

DESCRIPTION OF FAMILY RECORDS AS ASSEMBLED BY THE CLINIC

There is available for each clinic patient a family record in which the status as to tuberculosis of each member of the child's family is recorded, in so far as such data can be obtained. To assemble such a record, the home of each patient is investigated by medical social workers and a complete roster secured of all persons past and present, living and dead, who have been considered members of the household since the date of its establishment.

For each household member, identifying data such as name, sex, date of birth, date of entry into the household, and date of permanent removal are ascertained. Absences from home of any considerable length are also recorded. Where deaths have occurred, the cause of death is taken from hospital records or from the certificate of death, if such records can be located. The medical status

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[2] This paper is adapted from a more detailed study by the same author, published in the *American Journal of Hygiene*, January, 1940, 31, Sec. A., pp. 1-43.

of living members with reference to tuberculosis is investigated, as cooperation permits, by a thorough examination at a reputable hospital. For any adult actually ill with tuberculosis the date of the onset of symptoms is ascertained with care in order that duration of contact may be calculated for other members of the household. Most of the examinations of ill persons and their household associates have been made in the appropriate public dispensaries at the Johns Hopkins Hospital. Examination of adults includes a careful physical examination and an x-ray of the chest. In children under 14 years of age a careful physical examination is done and the tuberculin test applied. X-ray examinations of the chest are carried out on all children reacting positively to tuberculin.

Careful abstracts of medical records and a review of the chest x-rays are made by the director of the special clinic, so that the complete family record when assembled represents a concise account of the past and present health of each member of the household with respect to tuberculosis. In addition the medical social worker adds a narrative account of living conditions, income, and the precautions observed by the tuberculous adult, if the household contains one.

Each household is rechecked annually by the social workers for additions to, and removals from, the roster and for any items relative to the health of the family which should be covered in a follow-up study of tuberculosis. So far as possible, physical examinations are repeated annually, and considerably oftener in children registered during infancy in the special clinic.

Description of the Material of the Study

The present study is limited to households in which there is or has been a definitely diagnosed case of pulmonary tuberculosis in an adult, and it deals only with individuals entering the household under 15 years of age and followed only to 20 years of age. The number of families in the study is shown in Table 1 where the

families are classified according to the situation which led to the registration of the baby in the special clinic and to the epidemiological investigation of the child's family. Although all the families contained an adult known to have pulmonary tuberculosis, examination of the household was prompted by this circumstance in 202 of the 285 families, or in 71 per cent of the total number of families. These families have been designated as Group A. In the remaining eighty-three families, representing 29 per cent of the total number and designated as Group B, an infected child who was, however, not necessarily ill with tuberculosis, drew attention to the family.

Table 1. Distribution of families according to whether a tuberculous adult or child led to study of family.

Circumstance Leading to Study of Family	Families	
	Number	Per Cent of Total
	WHITE	
A. Tuberculosis in an Adult	108	78.26
B. Tuberculosis in a Child	30	21.74
TOTAL	138	100.00
	COLORED	
A. Tuberculosis in an Adult	94	63.95
B. Tuberculosis in a Child	53	36.05
TOTAL	147	100.00
	WHITE AND COLORED	
A. Tuberculosis in an Adult	202	70.88
B. Tuberculosis in a Child	83	29.12
TOTAL	285	100.00

The person, adult or child, whose tuberculous status leads to the investigation of the health of the other members of the household is known conventionally in such epidemiological studies as the *index case*. In an analysis which is primarily concerned with the measurement of the risk to which *unselected* persons of tuberculous households are subjected, that is, their probability of dying from tuberculosis, index cases must be excluded as necessarily already infected and undoubtedly more likely to die than the rest of the household yet to be examined. The majority of index cases for the households investigated were adults and therefore not included in a study of exposed children. Where the index cases happen to be chil-

dren, they have been excluded for the reasons given. This practice of excluding children acting as index cases makes for an overcorrection of data in the direction of giving us conservative figures for the risk to children of familial association with pulmonary tuberculosis.

Table 2 shows the number of families and the number of individuals included in the present study in groups A and B, according to the sputum status of the adult member known to have pulmonary tuberculosis. It will be seen that 248 of the 285 families had contact with sputum-positive or fatal cases of pulmonary tuberculosis. A much smaller group, only thirty-seven families, were subjected to a different type of contact. In twenty-nine of these households, the tuberculous adult was repeatedly sputum-negative, and in eight others the tuberculous adult survived and no sputum exam-

Table 2. Number of families and children entering household under 15 years of age, white and colored, included in present study.

	White		Colored	
	Families	Children	Families	Children
A. Families Referred for Examination Because of Known Contact With a Case of Pulmonary Tuberculosis Classed as:				
Sputum-Positive or Fatal	90	424	79	394
Sputum-Negative	16	69	10	43
Sputum Unknown	2	9	5	20
B. Families Referred Because of Demonstrated Infection in One or More Children, With Subsequent Discovery of a Case of Pulmonary Tuberculosis Classed as:				
Sputum-Positive or Fatal	29	112	50	294
Sputum-Negative	1	3	2	10
Sputum Unknown	—	—	1	5
Totals:				
Contact Case Sputum-Positive or Fatal	119	536	129	688
Contact Case Sputum-Negative or Questionable	19	81	18	78
Total	138	617	147	766

Total Families 285; Total Children 1,383.

ination was ever made. The two types of contact, involving only 159 individuals in this study, have been grouped together.

No attempt has been made to classify the families according to social and economic status or housing conditions. They all belong in a definitely "poor" group of families, who from necessity accept free medical care from a public dispensary.

The census of families and individuals by race is shown in Table 2. With the exception of infected children who served as index cases, and whose exclusion has already been explained, all children entering the household before 15 years of age are included, a total of 1,383 persons, 617 white and 766 colored.

Mortality

The children of this study were observed for varying periods of time both before and after the establishment of contact with a tuberculous adult. On December 31, 1937, when these records were compiled, some were living and some were dead. It was proposed to determine mortality both before and after contact had been established and to measure the difference in risk. No attempt has been made to relate actual duration of contact in time to mortality. The question asked was this: "Was the risk of dying subsequent to the onset of familial contact greater than it was before any known contact existed?"

The experience of each individual was divided according to whether it fell prior or subsequent to the onset of known contact with a tuberculous adult. It was found that 454 white and 650 colored children had spent part or all of their lives *before* tuberculosis made its appearance in the household, while 523 white and 594 colored children had come into known contact with a tuberculous adult, some of them at birth, others later. Eighty of the 523 exposed white children and eighty-eight of the 594 exposed colored children had been associated only with presumably sputum-negative disease, but the much larger remaining group of each race

had been subjected to contact with sputum-positive tuberculosis. Separate analyses were made in measuring mortality subsequent to the onset of the two kinds of contact; but in the small number of children exposed to supposedly sputum-negative disease, the calculated mortality carried a large sampling error and could not be shown to differ significantly from that determined for children exposed to sputum-positive disease. Accordingly, the rather small group of children associated, so far as was known, only with sputum-negative disease have been tabulated with the much larger number exposed to sputum-positive tuberculosis. This does not imply that household association with sputum-negative disease carries the same risk of death as contact with sputum-positive cases. In this study, however, the records of children associated with sputum-negative tuberculosis are too few, when considered separately, to permit a sound conclusion as to the force of mortality under this condition of exposure.

Technic for Determining Mortality Rates by the Modified Life-Table Method

To establish a comparison between mortality observed *before* and *after* the establishment of known contact, the observed deaths occurring under these two contrasting conditions must be expressed in terms of age-specific rates. To do this an actuarial or modified life-table procedure is employed which uses person-years as units of both number and time.

The observations for any individuals to be included in the table of life experience *prior* to known contact begin with their entry into the household at birth or some later age, and terminate with the establishment of contact, unless the individual died or left home permanently before contact took place. Children entering the household for the first time after the removal of the tuberculous adult are also included in this tabulation and, unless dying sooner, their experience ends at the latest observation. The life experience

of individuals *subsequent* to the beginning of contact starts with the date at which contact was established, sometimes at birth, usually at some later age, and ends with death or the latest observation.

The essential quantities for computing mortality rates which will be specific for age are (1) the number of persons dying during an age period, and (2) the mean number of persons under observation during a given period, otherwise known as the number of person-years. Then the mortality rate for a given age period is the ratio of the number of deaths at this age to the number of person-years. The formula for deriving the number of person-years has been published elsewhere together with the basic mortality tables for white and colored children of this study from birth to age 20, both *before* and *after* the establishment of household contact.[8] The rates obtained by the actuarial process indicated, whether determined for single years, or in convenient age groups, are equivalent to annual age-specific mortality rates such as are commonly used to describe current mortality in a given population, and they may be used for direct comparison.

Mortality for White and Colored Children to Age 20 After the Establishment of Known Household Contact

Mortality for white and colored children *after* the establishment of household contact is shown in summary form in Table 3. Death rates from all causes and from tuberculosis are shown separately. The rates given in Table 3 are annual rates, and where they apply to an age period of more than one year, they are the mean death rates experienced throughout that age period.

Table 3 indicates that the colored tend to suffer a considerably higher mortality than the white. It also shows that for both races the highest mortality is encountered during the first three years of

[8] Brailey, Miriam: A Study of Tuberculous Infection and Mortality in the Children of Tuberculous Households. *American Journal of Hygiene*, January, 1940, 31, Sec. A., pp. 1-43.

Age	Person-Years	Deaths			
		All Causes		Tuberculosis	
		Number	Rate per 1,000	Number	Rate per 1,000
White					
0-1	168.63	8	47.44	2	11.86
1	207.50	7	33.74	2	9.64
2	230.25	6	26.06	2	8.69
3	241.50	—	—	—	—
4	250.00	1	4.00	—	—
1-4	929.25	14	15.07	4	4.30
5-9	1,132.50	6	5.03	1	0.88
10-14	745.00	—	—	—	—
15-19	398.00	4	10.05	3	7.54
Colored					
0-1	134.06	16	119.35	8	59.68
1	172.50	11	63.77	5	28.99
2	198.75	14	70.44	9	45.28
3	211.50	2	9.46	1	4.73
4	226.00	1	4.42	—	—
1-4	808.75	28	34.62	15	18.55
5-9	1,051.25	4	3.80	4	3.80
10-14	721.25	2	2.77	2	2.77
15-19	370.00	9	24.32	8	21.62

Table 3. Age-specific mortality from all causes and from tuberculosis in 523 white and 594 colored children after the onset of known contact with adult pulmonary tuberculosis.

life, and this is true for tuberculosis as well as for all causes. There is a sharp decline in mortality, both from all causes and from tuberculosis in children of both races at age 3, and the lowest level of all is maintained fairly uniformly from 3 to 14 years of age. Thereafter, between 15 and 20 years of age, mortality from tuberculosis suddenly increases in both races but does not equal the risk suffered in infancy.

One should consider the age-specific mortality rates in exposed children in the light of the prevalence of infection demonstrated in the children of these families at various ages. Positive tuberculins were discovered in 29 per cent of exposed infants under 1 year of age in this study, and deaths from tuberculosis under 1 year of age

were confined to this rather small group. Once the first year of life was past, the prevalence of positive tuberculins increased sharply to more than 60 per cent, and yet at age 3 mortality from tuberculosis paradoxically begins to decline. It seems clear that no period in childhood suffers so high a case fatality as the first year of life.

In considering the mortality from tuberculosis in these families it should be remembered that tuberculous children serving as index cases were excluded from this study, and in consequence of their exclusion, death rates from tuberculosis are necessarily conservative. This effect is somewhat more pronounced in rates for the colored, who furnished a higher proportion of child index cases than did the white.

Comparison of Mortality Risk after the Onset of Contact With the Risk prior to Exposure; Unsoundness of Direct Comparison

One might suppose that a direct comparison could be made between mortality rates computed for individuals after the establishment of contact and rates prevailing before its establishment. But this would be an unsound procedure because most of the life experience *prior* to the establishment of contact occurred considerably earlier in time than did the life experience *after* known exposure to tuberculosis; and during the passage of time, death rates have been falling in Baltimore as in most large cities. This decline in death rates in recent years has been especially conspicuous in infant mortality and in mortality from tuberculosis. The force of this decline in mortality with time is such that in any direct comparison of mortality after contact with the risk of death before contact, the actual effect on mortality of intrafamilial association with tuberculosis may be completely masked by the decline in rates from earlier calendar years before contact to the later years after contact had begun.

Accordingly, before any comparison can be made involving the

passage of time, the observed mortality both before and after contact must be compared with the expected mortality had the life experience of these individuals been subjected to the rates prevailing in Baltimore during the calendar years these persons were under observation. By such a procedure allowance for the decline of mortality with time is made, and differences between observed and expected mortality can be shown clearly.

Description of Procedure Necessary for Accurate Comparison

The first step in this control procedure was to determine the mortality rates in Baltimore both for all causes and for tuberculosis during the calendar years for which the families of this study had supplied vital data, namely, from 1901 through 1937. With some

Table 4. Distribution in calendar years of life-experience in each age-period in tuberculous families before and after establishment of known contact.

Year	White Families				
	Age				
	0-1	1-4	5-9	10-14	15-19
	Person-years before contact				
1901-1905	6.51	11.79	—	—	—
1906-1910	9.30	29.03	17.45	—	—
1911-1915	22.78	42.64	42.71	17.20	—
1916-1920	59.98	145.16	54.20	45.87	14.76
1921-1925	92.07	273.09	159.84	59.73	48.43
1926-1930	102.30	232.73	187.86	100.82	27.67
1931-1935	53.02	146.07	84.74	44.91	14.76
1936-1937	6.04	17.24	14.70	11.47	1.38
Total	352.00	897.75	561.50	280.00	107.00
	Person-years after contact				
1911-1915	.50	.50	2.03	1.02	—
1916-1920	.50	8.46	7.10	9.20	9.24
1921-1925	20.98	58.53	28.82	9.73	10.77
1926-1930	78.33	288.26	271.51	126.57	44.31
1931-1935	59.36	490.92	603.68	443.44	222.65
1936-1937	8.96	82.58	219.36	155.04	111.03
Total	168.63	929.25	1,132.50	745.00	398.00

labor, population data and the numbers of deaths from all causes and from tuberculosis were collected for each of the calendar years under consideration. These were grouped for five-year periods beginning with 1901 and ending with a two-year interval, 1936 to 1937; and the mean annual age-specific rates for white and colored for the City of Baltimore were computed.

Turning to the person-years of life experience at each age in the individuals of this study, the next step was to distribute these person-years in the calendar years in which they fell, and then to collect them into semi-decades corresponding to those for which age-specific annual rates for Baltimore had been computed. The results of this distribution for white and colored population, respectively, are shown in Tables 4 and 5.

Table 5. Distribution in calendar years of life-experience in each age-period in tuberculous families before and after establishment of known contact.

Year	Colored Families				
	Age				
	0-1	1-4	5-9	10-14	15-19
	Person-years before contact				
1901-1905	2.77	9.27	1.90	—	—
1906-1910	12.04	25.04	12.82	2.34	—
1911-1915	24.08	55.17	33.72	18.72	3.67
1916-1920	53.71	139.08	80.73	35.57	18.84
1921-1925	101.40	280.93	193.28	88.92	47.78
1926-1930	132.88	361.52	290.39	152.56	70.29
1931-1935	109.73	285.10	163.12	137.35	57.89
1936-1937	20.14	49.14	41.79	14.04	11.03
Total	456.75	1,206.25	817.75	449.50	209.50
	Person-years after contact				
1911-1915	.51	—	—	—	—
1916-1920	6.14	15.41	1.60	—	—
1921-1925	8.24	28.75	35.29	11.44	—
1926-1930	39.58	166.66	166.05	99.67	43.44
1931-1935	63.85	470.56	611.17	416.56	217.98
1936-1937	15.74	127.37	237.14	193.58	108.58
Total	134.06	808.75	1,051.25	721.25	370.00

To calculate the mortality which would have occurred in these families during any five calendar years, if they had suffered the rates prevailing in the City, the mean mortality rate of the City for each age group in that five-year period is applied to the life experience falling within those years, distributed by age as shown in the tables. Repeating this process for each period of five calendar years, the "expected" deaths, that is, the number which would have occurred in each group during the whole series of years, are obtained by summation. The detailed tables showing the derivation of city rates during the various five-year periods and their application to the distributed life experience to obtain "expected" numbers of deaths are available in the reference previously given (Footnote 3).

Mortality from all Causes Both BEFORE and AFTER Contact Compared with Community Mortality

The summarized life-experience, the number of deaths expected at rates prevailing in the City, and the deaths actually observed at each age *before* and *after* the establishment of known contact are shown in Tables 6 and 7. Considering first the experience *before* contact in the *white* families, the number of deaths from all causes observed in children under 1 year of age falls considerably below the expected number and yet, beyond 1 year of age, observed deaths for the years 1 to 19 significantly outnumber the expected. Underenumeration of deaths in early infancy probably accounts for this inconsistency. In a study where data are secured in retrospect for an interval of time extending from the date of establishment of household to the date the index case was encountered, there are many pitfalls in enumeration of former members of the household, however carefully the field work is done. Such data are probably the least reliable with respect to neonatal deaths.

If children under 1 year of age are excluded, it can be seen in Table 8 that the white families of this study prior to contact showed a total mortality 1.9 times greater than that expected, had the city

Age	Person-Years	Deaths			
		All Causes		Tuberculosis	
		Expected	Observed	Expected	Observed
		WHITE			
0-1	352.00	32.26	27	0.334	0
1-4	897.75	8.15	16	0.452	0
5-9	561.50	1.38	4	0.061	0
10-14	280.00	0.49	0	0.033	0
15-19	107.00	0.29	0	0.071	0
1-19	1,846.25	10.31	20	0.617	0
0-19	2,198.25	42.57	47	0.951	0
		COLORED			
0-1	456.75	69.20	48	1.536	1
1-4	1,206.25	23.32	13	3.235	2
5-9	817.75	3.35	3	0.822	2
10-14	449.50	1.76	3	0.658	2
15-19	209.50	1.69	1	0.930	1
1-19	2,683.00	30.12	20	5.645	7
0-19	3,139.75	99.32	68	7.181	8

Table 6. Application of calculated Baltimore mortality rates to the life-experience of the white and colored tuberculous families *before onset of known contact.*

rates prevailed. This is not unexpected, for a public dispensary attracts the poorer white families who live under conditions considerably below those of the average white city resident.

The *colored* families prior to known contact with tuberculosis showed forty-eight deaths from all causes during the first year of life when sixty-nine were expected; and between 1 and 4 years of age thirteen children died when twenty-three deaths from all causes were expected. If under-enumeration of deaths in early infancy played a rôle in the collection of data from white families, such an effect might be expected in more exaggerated form in the colored where larger households and a higher infant mortality would tax the memory of the informant more severely. It is probable, therefore, that under-enumeration played a considerable rôle in the unexpectedly low mortality recorded for colored children under

Age	Person-Years	Deaths			
		All Causes		Tuberculosis	
		Expected	Observed	Expected	Observed
		WHITE			
0-1	168.63	12.22	8	0.104	2
1-4	929.25	5.60	14	0.283	4
5-9	1,132.50	2.10	6	0.070	1
10-14	745.00	1.05	0	0.043	0
15-19	398.00	0.78	4	0.140	3
1-19	3,204.75	9.53	24	0.536	8
0-19	3,373.38	21.75	32	0.640	10
		COLORED			
0-1	134.06	16.29	16	0.380	8
1-4	808.75	8.82	28	1.423	15
5-9	1,051.25	2.70	4	0.650	4
10-14	721.25	2.25	2	0.906	2
15-19	370.00	2.53	9	1.408	8
1-19	2,951.25	16.30	43	4.387	29
0-19	3,085.31	32.59	59	4.767	37

Table 7. Application of calculated Baltimore mortality rates to the life-experience of the white and colored tuberculous families *after onset of known contact.*

1 year of age prior to contact; and it is altogether possible that this error was extended and operated to a lesser degree in the record of deaths from all causes for children aged 1 to 4.

Table 8. Summary of observed and expected mortality, *ages* 1-19, *from all causes* in white and colored families exposed to adult pulmonary tuberculosis, before and after onset of known contact.

	Observed Deaths	Expected Deaths	Ratio: Observed / Expected
White			
Before Contact	20	10.31	1.94
After Contact	24	9.53	2.52
Colored			
Before Contact	20	30.12	0.66
After Contact	43	16.30	2.64

Excluding children under 1 year of age it is found, on referring to Table 8, that prior to contact the observed mortality from all causes in the colored was two-thirds that expected had the city rates prevailed. This difference

between expected and observed number of deaths is not quite large enough to exclude the operation of chance alone, and it is possible that the figure for observed deaths represents a chance variation from city experience. If the difference is real, and under-enumeration plays no significant rôle beyond 1 year of age, then the colored of our series prior to contact appear to have represented a standard of living and a risk of mortality somewhat more favorable than the average colored family in the City of Baltimore.

Subsequent to the onset of intrafamilial contact with pulmonary tuberculosis, the observed total mortality in both races becomes more than twice that expected at prevailing city rates. It will be seen from Table 8 that for white families the ratio of observed to expected deaths from all causes rises from 1.94 *before* known contact to 2.52 *after* the beginning of contact, an increase of only 30 per cent in the ratio. In contrast to the white, the colored families showed a marked increase in the observed to expected mortality following the establishment of exposure to tuberculosis. The number of deaths from all causes observed for the colored, aged 1 to 19, subsequent to contact, is 2.64 times greater than the number of deaths expected at city rates. If the ratio of 0.66 *prior* to contact is correct, then the ratio of observed to expected deaths *after* contact began is four times greater, representing a 300 per cent increase. Even if we suppose a precontact ratio of 1 to be more nearly correct, the increase in observed mortality over that expected, as indicated by the ratio, remains striking.

Thus, in measuring mortality from all causes in these tuberculous households, it has been assumed that the relationship between familial hazard and community hazard should remain constant both before and after contact, unless tuberculosis within the family upsets this relationship. In the white children of this series, the ratio of familial to community hazard was observed to increase after exposure began, but the increase was small so far as mortality from all causes was concerned. In the colored families, however, the

ratio of familial to community hazard in deaths from all causes took a sharp jump after tuberculosis appeared in the family, and the ratio increased 300 per cent over that noted prior to contact.

Mortality from Tuberculosis both Before and After Contact Compared with Community Mortality from Tuberculosis

It will be seen from Table 6 that prior to contact less than one death from tuberculosis would have been expected at prevailing city rates in the life experience of children of the white families up to age 20. No deaths from tuberculosis occurred. In the colored from birth to age 20, seven deaths from tuberculosis were expected and eight occurred. Because there is no evidence for under-enumeration of deaths from tuberculosis in early infancy, the ratios of observed to expected mortality from tuberculosis, before and after exposure began, have been calculated for the whole of the first 20 years of life and are shown in Table 9.

After the establishment of known contact, white children to age 20 suffered ten deaths from tuberculosis when only 0.6 death was expected. Thus, the observed mortality from tuberculosis, once contact began, was 15.6 times greater than the community mortality from tuberculosis.

Table 9. Summary of observed and expected mortality, *ages* 0-19, *from tuberculosis* in white and colored families exposed to adult pulmonary tuberculosis, before and after onset of known contact.

	Observed Deaths	Expected Deaths	Ratio: Observed / Expected
White			
Before Contact	0	0.951	—
After Contact	10	0.640	15.6
Colored			
Before Contact	8	7.181	1.11
After Contact	37	4.767	7.76

In the colored families thirty-seven deaths from tuberculosis were observed subsequent to contact and 4.8 were expected; the observed mortality being 7.8 times greater than that anticipated, had the city rates been in force. The lower ratios of

observed to expected deaths from tuberculosis for the colored, as shown in Table 9, are due solely to their higher community attack rate from tuberculosis, which increases the number of expected deaths forming the denominator of the ratio. It will be remembered, from Table 3, that the risk of dying from tuberculosis suffered from birth to age 20 by those who have had contact with adult tuberculosis, is three or four times greater for colored children than for white.

Conclusions

This study of mortality in the children of 138 white and 147 colored families exposed to pulmonary tuberculosis in an adult indicates that, while the death rates from tuberculosis are strikingly increased over normal expectancy for both races, tuberculosis mortality in the *white* families of our series was not sufficiently high to increase in a marked way the total mortality from which such families were already suffering. The *colored,* however, have a mortality from tuberculosis three or four times greater than the white, once exposure has been established, and these deaths from a specific cause are numerous enough to increase very greatly the total mortality in these families. In both white and colored families, *after* the establishment of contact, the highest mortality from tuberculosis under 20 years of age occurred in children under 3 years of age, case-fatality being highest in infants under 1 year.

FACTORS UNDERLYING INDIVIDUAL AND GROUP DIFFERENCES IN UNCONTROLLED FERTILITY

REGINE K. STIX, M.D.[1]

INTRODUCTION

RECENT studies of the contraceptive practices of American women indicate that "if it were not for the effect of contraceptive efforts and the practice of criminal abortion, together with correlated habits as to postponement of marriage, there would apparently be little or no significant differential fertility as between economic, educational, or religious classes of urban American married couples."[2] Pearl also found that in the absence of contraception the pregnancy rates of Negroes did not differ significantly from those of white women.[3] In studies of patients of birth control clinics, it was found that there were no significant differences in the uncontrolled fertility of different religious groups or of different social and occupational classes.[4]

It may not be assumed, however, that, because no broad group differences were demonstrable, individual couples did not vary in reproductive capacity. Actually, wide individual differences were observed and it can be shown that couples with high native fertility were doubtless aware of their ability to reproduce rapidly and turned to the use of contraception early in order to curb their fertility.

[1] From the Milbank Memorial Fund.

[2] Pearl, Raymond: THE NATURAL HISTORY OF POPULATION. New York, Oxford University Press, 1939, p. 244.

[3] *Op. cit.*, p. 224.

[4] Stix, R. K. and Notestein, F. W.: Effectiveness of Birth Control. A Second Study. The Milbank Memorial Fund *Quarterly*, April, 1935, xiii, No. 2, pp. 170-171.

Stix, R. K. and Notestein, F. W.: CONTROLLED FERTILITY: AN EVALUATION OF CLINIC SERVICE. Baltimore, The Williams and Wilkins Co. In press. Chapter V, Tables 13, 14.

Stix, R. K.: Birth Control in a Midwestern City. The Milbank Memorial Fund *Quarterly*, January, 1939, xvii, No. 1, p. 81 and Table 4.

A number of factors may influence fertility in the absence of contraception.[5] One is the presence of varying degrees of pelvic and endocrine pathology. Less is known of the influence of other pathological processes on the reproductive capacity of the individual or couple, but results of animal experiments suggest that certain nutritional deficiencies probably lower reproductive capacity.

Among couples who have no demonstrable pelvic or endocrine pathology there may be differences in the length of lactation and amenorrhea following pregnancy which may account for fairly wide differences in the rate at which all conceptions after the first take place, when no contraception is used. It is a matter of common knowledge that the period immediately following a pregnancy is relatively infertile; that there is probably an anovulatory period coincidental with postpartum amenorrhea and that there may be additional anovulatory cycles during lactation, even after menstruation has been resumed.[6] There are no data showing the effect of these periods on the rate of conception.

In the course of the study of the controlled and uncontrolled fertility of the patients of two birth control clinics, information was secured on the length of amenorrhea and of lactation which followed each pregnancy occurring between the woman's first marriage and her initial visit to the clinic. It is almost impossible to elicit precise information of this sort, and it is probable that the length of lactation and amenorrhea reported for many individual pregnancies is inaccurate. It was felt, however, that a gross appraisal of the data might throw some light on the differences in mores in the two areas represented and on the influence of postpartum amenorrhea on fertility.

[5] The frequency of coitus may influence fertility in the absence of contraceptive practice, but data on coital frequency are unreliable. On the basis of available data it may be concluded that observed differences in noncontraceptive rates are negligible. *See* Stix: Birth Control in a Midwestern City, p. 82 and Table 6; and Stix, R. K.: The Medical Aspects of Variations in Fertility. *American Journal of Obstetrics and Gynecology,* April, 1938, 35, No. 4, pp. 577-578 and Table IV.

[6] Lass, Paul; Smelser, Jane; and Kurzrok, Raphael: Studies Relating to Time of Human Ovulation. *Endocrinology,* July, 1938, xxiii, No. 1, pp. 39-43.

The Source of the Material

Detailed fertility records, covering the period from marriage to the date of the initial contact with a birth control clinic, were secured from 1,621 white women in Cincinnati, Ohio, who had attended the clinics of the Cincinnati Committee on Maternal Health. Similar records were obtained from 533 white women and 457 Negro women who were referred to the Maternal Health Clinic of the Spartanburg County Health Department, in Spartanburg, South Carolina.[7] In both areas the women came mainly from low-income families and families on relief and were almost all native-born Protestants.[8] About 60 per cent of the Spartanburg patients, both white and Negro, were the wives of manual workers in the city of Spartanburg or in the cotton-mill towns in the County. The remaining 40 per cent of each group were the wives of sharecroppers, tenant farmers, or farm laborers in the rural sections of Spartanburg County.

The clinic patients in both Cincinnati and Spartanburg were unusually fertile women. The average wife of a manual laborer in Cincinnati had had 5.0 pregnancies and 4.0 live births when she first came to the clinic for contraceptive advice. Spartanburg white patients were even more fertile, with a preclinic average of 5.0 pregnancies and 4.3 live births for the urban women and 5.7 pregnancies and 5.1 live births for those from rural areas. The Negro urban women averaged 6.0 pregnancies and 5.0 live births and those from the farms 6.6 pregnancies and 5.7 live births.[9]

[7] The record of each Spartanburg patient contained a medical history, the digest of a medical examination, the record of a complete pelvic examination, and laboratory reports on urine, smears, and serological tests for syphilis. Each Cincinnati patient was given the routine pelvic examination necessary for fitting a contraceptive diaphragm and selected patients were referred for special gynecologic care. The gynecologic records of these patients were available for study.

[8] For a more detailed description of the Cincinnati group, *see:* Stix: Birth Control in a Midwestern City, pp. 72-74.

[9] All averages were standardized to the age distribution of all women 15-45 years of age in the 1930 census.

Only the records of women for whom there was no evidence of gross pelvic or endocrine pathology were included in the present study. All Spartanburg women who had positive evidence of syphilis or whose husbands had syphilis were also excluded, as were a small number of cases in which either the husband or wife had pellagra. The records were, therefore, those of women who had no pathology that might be presumed to affect their fertility. There were 1,208 such cases in Cincinnati and 353 white and 260 Negro cases in Spartanburg.

Uncontrolled Fertility

When all cases with gross pathology were excluded from the tabulations, it was found that the Cincinnati women and the Spartanburg Negroes had slightly but significantly higher pregnancy rates, when no contraception was used, than did the white women in Spartanburg.[10]

The noncontraceptive pregnancy rates for the three groups of women are shown in Table 1. The rates for first pregnancies did not differ significantly in the three groups.[11] For all pregnancies after the first, however, the Spartanburg white women had significantly lower rates than either of the other groups. The rates for the Negro women in Spartanburg did not differ significantly from those for white women in Cincinnati, but they were higher than those for white women in the Spartanburg area.[12] In neither the

[10] The pregnancy rates used in this study are expressed in terms of the number of pregnancies occurring in 100 person-years of exposure to the risk of pregnancy when no contraception was used. Exposure to pregnancy is that period of a woman's married life between menarche and menopause during which she is living with her husband and not pregnant or in the puerperium, and during which she is, therefore, more or less regularly exposed to the risk of becoming pregnant. *See* Stix, R. K. and Notestein, F. W.: The Effectiveness of Birth Control. The Milbank Memorial Fund *Quarterly*, January, 1934, xii, No. 1, pp. 59-64, for a detailed explanation of the method of calculating pregnancy rates.

[11] The t test was used to test the differences between the arithmetic means of the distributions of exposures to first pregnancies. Values of p lower than .05 were considered to indicate significant differences.

[12] In testing the significance of the differences in rates for pregnancies after the first, the χ^2 test was used. The test is not ideally suited to the data, but is the best available for the

(Continued on page 243)

Period of Married Life	Cincinnati	Spartanburg	
		White	Negro
	Pregnancies per 100 years of exposure		
First Pregnancies	189	194	200
All Later Pregnancies	96	75	91
Years Since Marriage			
0-4	102	83	99
5-9	99	77	90
10-14	82	64	76
15-29	71	60	72
	Number of years of exposure and number of pregnancies		
	Exp. Yrs. / No. Preg.	Exp. Yrs. / No. Preg.	Exp. Yrs. / No. Preg.
First Pregnancies	434.8 / 821	144.6 / 280	99.7 / 199
All Later Pregnancies	1,277.5 / 1,229	969.2 / 730	818.2 / 741
Years Since Marriage			
0-4	733.2 / 747	390.9 / 323	376.7 / 372
5-9	284.7 / 282	313.2 / 242	257.3 / 232
10-14	150.6 / 123	168.2 / 107	118.9 / 90
15-29	108.9 / 77	96.9 / 58	65.2 / 47

[1]All cases with known pathology were excluded from this tabulation and from the ones following.

Table 1. Pregnancy rates for three groups of women when no contraception was used.[1]

white nor the Negro Spartanburg group did the rates for urban women differ significantly from those for women from the rural areas.

In Cincinnati, the women who turned to the use of contraception before the tenth year of married life had significantly higher pregnancy rates than did those women who had exposure without contraception after the tenth year of married life.

The same type of selection appears to have been present in both Spartanburg groups, but to a much less marked degree (Table 2). The first pregnancy rates for both whites and Negroes who used

purpose. Values of p lower than .02 were considered to indicate significant differences; those higher than .10 to show no significant differences. Values of p falling between .02 and .10 were considered to be of doubtful significance and will be given in footnotes.

Period of Married Life	Cincinnati		Spartanburg			
			White		Negro	
	Group A	Group B	Group A	Group B	Group A	Group B
	Pregnancies per 100 years of exposure					
First Pregnancies	144	194	140	227	131	242
All Later Pregnancies Years Since Marriage						
0-4	82	107	78	86	97	100
5-9	81	130	76	79	80	108
10-14	82		64		76	
15-29	71		60		72	
	Number of years of exposure and number of pregnancies					
	Exp. Yrs. / No. Preg.	Exp. Yrs. / No. Preg.	Exp. Yrs. / No. Preg.	Exp. Yrs. / No. Preg.	Exp. Yrs. / No. Preg.	Exp. Yrs. / No. Preg.
First Pregnancies	46.5 / 67	388.3 / 754	55.0 / 77	89.6 / 203	38.2 / 50	61.5 / 149
All Later Pregnancies Years Since Marriage						
0-4	153.2 / 125	580.0 / 622	172.1 / 135	218.8 / 188	116.6 / 113	260.2 / 259
5-9	179.2 / 145	105.6 / 137	219.7 / 168	93.4 / 74	161.7 / 129	95.6 / 103
10-14	150.6 / 123		168.2 / 107		118.9 / 90	
15-29	108.9 / 77		96.9 / 58		65.2 / 47	

Table 2. Noncontraceptive pregnancy rates for women who had exposure without contraception *after* the tenth year of married life (Group A), and for those who turned to the exclusive use of contraception or attended a birth control clinic *before* they had been married ten years (Group B).

contraception early were significantly higher than those for women who had exposure without contraception after the tenth year of married life, but the differences in the rates for later pregnancies were not significant.[18] Both Spartanburg white groups, however,

[18] In both Cincinnati and Spartanburg, women who attended the clinic before the tenth year of married life were included as having no exposure without contraception after the tenth year of married life. Although almost no women in Cincinnati had exposure without contraception after clinic attendance, this was not true of either white or Negro women in Spartanburg, many of whom continued to use no contraception even after contraception had been made available to them. This doubless accounts for the small amount of selection shown in the Spartanburg sample.

had pregnancy rates significantly lower than those of the corresponding Negro groups.[14] The rates for white women who had exposure without contraception after the tenth year of married life were not significantly different from those for the Cincinnati women. The rates for the group who turned to contraception early were, however, significantly lower than those for the parallel group of Cincinnati women, while in neither case did the rates for the Negro and the Cincinnati groups differ significantly.

The exclusion of all cases with known pathology from the sample studied eliminates one important factor affecting uncontrolled fertility.[15] Differences in length of lactation and associated puerperal amenorrhea probably account for some of the remaining disparity in rates.

Lactation and Amenorrhea

The length of lactation reported by different individuals for individual pregnancies varied widely both in Cincinnati and in Spartanburg. Because of the unreliability of this type of reporting, little confidence can be placed in any except gross figures. The mean number of months of lactation per live birth and the mean number of months of amenorrhea per pregnancy are probably fairly accurate for the experience of a large number of women,[16] inasmuch as in the assembled data errors in one direction are counterbalanced by errors in the opposite direction.

In both Cincinnati and Spartanburg, the average length of lactation per live birth was longer for women who came to the clinic

[14] In the comparison of the rates for white and Negro women with noncontraceptive exposure after the tenth year of married life, the value of p was between .02 and .05.

[15] Pregnancy rates, without contraception, of cases with pelvic and/or endocrine pathology were found to be significantly lower than the rates of the nonpathological cases. *See* Stix: Birth Control in a Midwestern City, p. 79, Table 4 and footnote 14; and The Medical Aspects of Variations in Fertility, pp. 572-593 and Table 1.

[16] The number of months of lactation per live birth and the number of months of amenorrhea per pregnancy were found to be about the same for pregnancies occurring when contraception was used as for those occurring when none was used. Since the lactation and amenorrhea following a pregnancy conceived before contraception was used may coincide with exposure during which contraceptives were used, the means were computed for all pregnancies, whether preceded by the use of contraception or not.

after they had been married for ten years or more than for younger women who came to the clinic earlier in their married lives. There was little variation in the mean length of lactation per live birth in the three social class groups in Cincinnati, for women married approximately the same length of time.

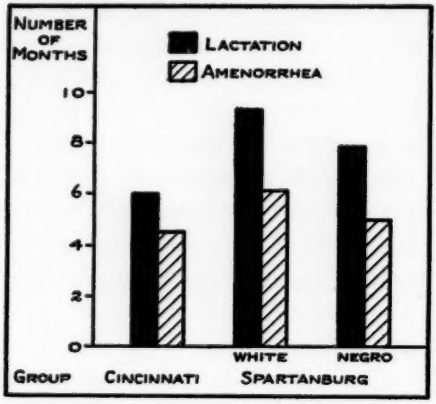

Fig. 1. Mean number of months of lactation per live birth and mean number of months of amenorrhea per pregnancy for three groups of women.

In Spartanburg, the mean length of lactation per live birth was consistently higher among both whites and Negroes than in Cincinnati (Table 3 and Fig. 1). The average for white women in Spartanburg was consistently higher than the average for Negroes. Wives of farmers nursed their babies longer than wives of city-employed workers: 8.4 months per live birth for white women in the urban areas as compared with 10.5 months for white women in the rural areas.

Table 3. Mean number of months of lactation per live birth and mean number of months of amenorrhea per pregnancy for three groups of women.[1]

	Cincinnati	Spartanburg	
		White	Negro
Mean Number of Months of:			
Lactation per Live Birth	6.0	9.3	7.8
Amenorrhea per Pregnancy	4.5	6.1	4.9
Number of:			
Live Births	3,946	1,218	913
Pregnancies	4,808	1,390	1,047

[1]Includes experience for all pregnancies, whether conception was preceded by exposure with contraception or without.

On the whole, these are the findings to be expected, for it is a matter of common knowledge that in the poorer economic groups living in the South prolonged nursing is the rule rather than the exception. A few women in the Spartanburg group nursed their children for three years or longer, doubtless because they believed that in this way they might be protected against further pregnancy.

Length of lactation, when lactation is physiologically possible, is to a great extent a matter of voluntary control on the part of the mother. In urban areas, especially in the industrialized North, the mother's attitude may be modified by the advice of a clinic or personal physician. Since most pediatricians regard six or seven months as the optimal length of time for breast feading, the mean length of lactation is shorter for groups of women to whom such advice is available than for women who feed their infants without the benefit of medical direction.

In the South, especially in the rural areas, medical supervision throughout infancy is not usual. The rural families had little or no cash income, and it is not surprising that the rural mother found the breast the simplest as well as the most economical and dependable source of food for her baby.

The difference between the average length of lactation among white and among colored women is more difficult to explain. Many of the Negro women were domestic servants, working by the day, and in order to continue as wage-earners it may have been necessary for them to wean their babies relatively early.

The mean length of amenorrhea per pregnancy differed less in the three groups than did the mean length of lactation per live birth (Table 3 and Fig. 1). The group relationships were in the same direction, however; and amenorrhea, like lactation, was somewhat more prolonged in the experience of older women than it was in the experience of younger ones. It is probable that the length of the postpartum period of amenorrhea depends to a great extent on the associated length of lactation.

The Influence of Postpartum Amenorrhea on the Risk of Conception

Between 37 and 40 per cent of the noncontraceptive exposure of each group of women coincided with periods of postpartum amenorrhea. If such periods were anovulatory, they would be expected to constitute a very effective protection against further pregnancy. That they actually did do so may be seen by comparing the rates, for pregnancies after the first, in Table 4 with those in Table 1.[37]

Table 4. Noncontraceptive pregnancy rates for three groups of women, with all exposure and pregnancies occurring during periods of amenorrhea excluded.

Period of Married Life	Cincinnati	Spartanburg	
		White	Negro
	Pregnancies per 100 years of exposure		
First Pregnancies[1]	189	194	200
All Later Pregnancies	140	122	140
Years Since Marriage			
0-4	150	143	159
5-9	139	122	137
10-14	103	93	115
15-29	102	95	99
	Number of years of exposure and number of pregnancies		
	Exp. Yrs. / No. Preg.	Exp. Yrs. / No. Preg.	Exp. Yrs. / No. Preg.
First Pregnancies[1]	434.8 / 821	144.6 / 280	99.7 / 199
All Later Pregnancies	801.8 / 1,123	580.5 / 706	517.4 / 723
Years Since Marriage			
0-4	448.0 / 671	218.6 / 312	228.2 / 362
5-9	188.2 / 262	192.7 / 235	166.9 / 228
10-14	94.2 / 117	109.2 / 101	76.7 / 88
15-29	71.4 / 73	60.0 / 57	45.6 / 45

[1]Rates of first pregnancies are identical with those in Table 1, since there can be no period of puerperal amenorrhea until there has been at least one pregnancy.

[37] The rates in Table 4 were derived by subtracting from the noncontraceptive exposure and pregnancies in each five-year period of married life, after the first pregnancy, the exposure coinciding with periods of postpartum amenorrhea and the pregnancies conceived before menstruation was reestablished. When the reported length of amenorrhea exceeded the exposure between pregnancies, it was assumed that menstruation was resumed one month before conception took place, unless the conception was reported to have occurred before menstruation was reestablished.

The rates in Table 4 are those which would have occurred if there had been no postpartum amenorrhea in the noncontraceptive exposure to pregnancy of the three groups of women. In the Cincinnati group the estimated rates are about 45 per cent higher than the observed rates, while the estimated rates for the Spartanburg white women are about 63 per cent higher and those for the Spartanburg Negro women about 54 per cent higher than the observed rates of the same groups.

The major part of the difference between the rates for Spartanburg white women and for Cincinnati women may be ascribed to the fact that, because of prolonged lactation, the proportion of exposure which coincided with postpartum amenorrhea and in which the risk of pregnancy was, therefore, reduced, was greater in the Spartanburg white group than in the Cincinnati group. The Cincinnati rates remained slightly, but probably not significantly, higher after this factor was taken into account.[18] The reduction of the differences between the two sets of rates when the amenorrheic exposure and pregnancies were excluded from both is depicted graphically in Figure 2A. The noncontraceptive rates for the Cincinnati women were 28 per cent higher than those for the Spartanburg white women, but if neither group had had any postpartum amenorrhea the rates for the Cincinnati women would have exceeded those for the Spartanburg white women by less than 15 per cent.

The rates for Negro women in Spartanburg were almost identical with those for the Cincinnati white women, when the amenorrheic pregnancies and exposure were excluded. The Negro rates remained slightly but significantly higher than those for Spartanburg white women, however, even with amenorrhea held constant.[19]

[18] The value of p for the comparison of rates for all pregnancies after the first, with amenorrhea excluded, was between .02 and .05.

[19] The value of p for the comparison of rates for all pregnancies after the first was about .02.

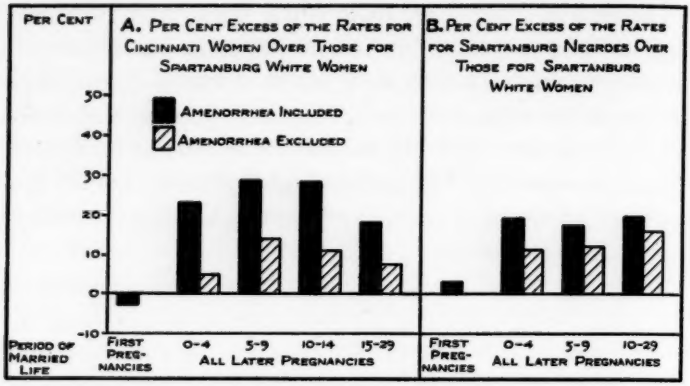

Fig. 2. Per cent excess of the noncontraceptive pregnancy rates for Cincinnati women and for Spartanburg Negro women over the corresponding rates for Spartanburg white women when exposure and pregnancies occurring during periods of amenorrhea were included and when they were excluded.

Had neither Spartanburg group had any postpartum amenorrhea the rates for Negro women would have exceeded the rates for white women by about 15 per cent, while for the observed rates the difference was about 21 per cent (Fig. 2B).

Differences were less, however, when the rates of women who had exposure without contraception after the tenth year of married life and those of women who turned to contraception early, in each group, were compared with those of women with parallel experience in the other groups (Table 5 and Fig. 3). There were no significant differences in the rates for the three groups of women with a similar attitude toward contraception, when the exposure and pregnancies occurring during amenorrhea were excluded from the rates.[20]

After the first pregnancy, the differences in the noncontraceptive pregnancy rates,[21] for women who did and did not have exposure

[20] The value of p for the comparison of rates for white and Negro women in Spartanburg, who turned to contraception early, for all pregnancies after the first, was between .05 and .10. Values of p for all other comparisons were higher than .10.

[21] For the first ten years of marriage.

without contraception after the tenth year of married life, appear to have depended largely on the fact that women who delayed the use of contraception had longer periods of postpartum amenorrhea than did women who turned to contraception early. In the case of the Cincinnati women and of the Spartanburg Negro women, the exclusion of amenorrheic exposure and pregnancies from both

Table 5. Noncontraceptive pregnancy rates with amenorrheic exposure and pregnancies excluded, for women who had exposure without contraception *after* the tenth year of married life (Group A) and for those who turned to the exclusive use of contraception, or attended a birth control clinic *before* the tenth year of married life (Group B).

Period of Married Life	Cincinnati		Spartanburg			
			White		Negro	
	Group A	Group B	Group A	Group B	Group A	Group B
	Pregnancies per 100 years of exposure					
First Pregnancies[1]	144	194	140	227	131	242
All Later Pregnancies Years Since Marriage						
0-4	143	151	138	146	155	160
5-9	122	163	119	130	118	169
10-14	124		93		115	
15-29	102		95		99	
	Number of years of exposure and number of pregnancies					
	Exp. Yrs. / No. Preg.	Exp. Yrs. / No. Preg.	Exp. Yrs. / No. Preg.	Exp. Yrs. / No. Preg.	Exp. Yrs. / No. Preg.	Exp. Yrs. / No. Preg.
First Pregnancies[1]	46.5 / 67	388.3 / 754	55.0 / 77	89.6 / 203	38.2 / 50	61.5 / 149
All Later Pregnancies Years Since Marriage						
0-4	76.2 / 109	371.7 / 562	94.7 / 131	123.9 / 181	70.1 / 109	158.1 / 253
5-9	108.9 / 133	79.2 / 129	135.7 / 161	56.9 / 74	106.5 / 126	60.4 / 102
10-14	94.2 / 117		109.2 / 102		76.7 / 88	
15-29	71.4 / 73		60.0 / 57		45.6 / 45	

[1]Rates of first pregnancies are identical with those in Table 2, since there can be no period of puerperal amenorrhea until there has been at least one pregnancy.

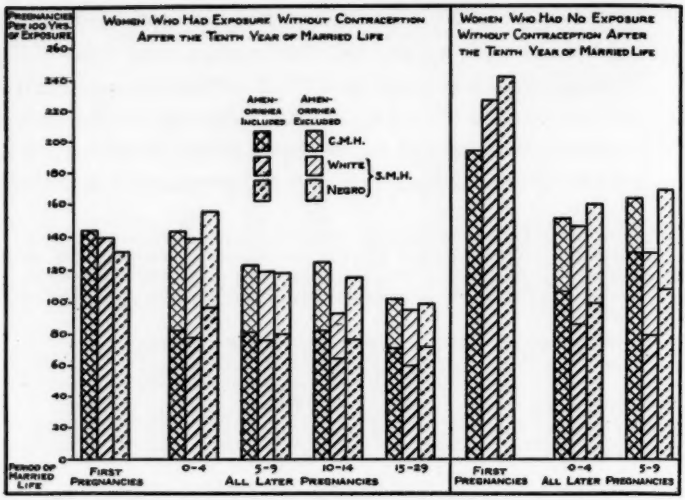

Fig. 3. Noncontraceptive pregnancy rates of women who did and did not have exposure without contraception after the tenth year of married life, when exposure and pregnancies occurring during periods of amenorrhea were included and when they were excluded.

sets of rates left only a borderline difference between them.[22] The rates for the Spartanburg white women who turned to contraception early were not significantly different from those for women who delayed its use. In other words, the women who delayed the use of contraception depended to a great extent on prolonged nursing and associated amenorrhea to protect themselves against further pregnancy.

The protection afforded by amenorrhea may be estimated with some precision in terms of the per cent of excess pregnancies which would have occurred had there been no amenorrhea in the exposure to the risk of pregnancy. If the Cincinnati women had had no amenorrhea, they would have had about 20 per cent more pregnancies than they actually did have, while the two groups of

[22] In each case the value of p was between .05 and .10.

Spartanburg women, under similar circumstances, would have had about 30 per cent more (Table 6).

In all three groups, the women who delayed the use of contraception would have had about 33 per cent more pregnancies had they had no puerperal amenorrhea. Those who turned to contraception early, in Cincinnati, would have had about 16 per cent more pregnancies, and the two Spartanburg groups between 28 and 30 per cent more pregnancies than they actually had.

Table 6. Per cent of pregnancies prevented by the presence of amenorrhea in the noncontraceptive exposure to pregnancy of three groups of women.

Group of Women	Per Cent of Pregnancies Prevented by Amenorrhea	
	Per Cent of All Pregnancies	Per Cent of All Pregnancies After the First
Cincinnati	20.6	30.2
Spartanburg		
White	31.3	38.7
Negro	30.5	35.7

It is possible that some women who continued to nurse their babies after menstruation was reestablished had additional periods of partial protection against pregnancy associated with lactation.[28] The exact measurement of the effects of lactation and amenorrhea on the rate of conception must await more accurate data than are at present available.

Residual Differences in Uncontrolled Fertility

Even after the exposure and pregnancies of all pathological cases were excluded from the tabulations and the differences in amount of amenorrhea in the three groups were held constant, by estimating for each group the rates which would have obtained had there been no amenorrhea, certain minor residual differences in uncontrolled fertility remained. The rates of the Spartanburg white women were consistently lower in all durations of marriage than those of the Negro women or of white women in the Cincinnati area

[28] *See:* Lass, *et al: op. cit.*

(Tables 1 and 4). In addition, the first pregnancy rates of women in all three groups, who turned to contraception early, were significantly higher than those of women who delayed the use of contraception.[24]

We may only speculate about the reasons for these differences, since there are no data available to elucidate them. It is possible that differences in nutrition may play some part in them. The prevalence of nutritional deficiency is high in the South, and although much has been done in Spartanburg to treat frank cases of pellagra, diets remain extremely low in the protective foods. Recent clinical research has shown the widespread prevalence of multiple nutritional deficiencies.

In 1915, Siler and his associates found that in Spartanburg County, township by township, pellagra was about three times as prevalent among whites as among Negroes.[25] It is probable that pellagra is less prevalent now than it was in 1915, but there is no reason to believe that the difference between the white and the Negro morbidity has been greatly altered.

Negro nutrition may be slightly better than that of whites in similar economic circumstances, because many Negroes are domestic workers in the homes of economically well-to-do people in the community. It is an accepted custom in the South for domestic workers to carry food home with them. Thus, the Negro domestic worker and her family are probably better fed than white or Negro workers in the same economic circumstances, who have no access to supplementary food sources.

An indirect test of the influence of nutrition on fertility was made by comparing the pregnancy rates of Negro domestic workers with

[24] It was thought that the difference in rates for first pregnancies might be associated with differences in coital frequency. In all three groups, however, for each reported frequency of coitus the rates for women who turned to contraception early were consistently—and, in most instances, significantly—higher than those of women who delayed its use.

[25] Siler, J. F.; Garrison, P. E.; and MacNeal, W. J.: Statistics of Pellagra in Spartanburg County, South Carolina. *Archives of Internal Medicine*, January, 1915, xv, pp. 98-120.

Period of Married Life	Domestic Workers		Other Negroes	
	Pregnancies per 100 years of exposure			
First Pregnancies	204		197	
All Later Pregnancies	95		88	
Years Since Marriage				
0-4	103		96	
5-9	97		87	
10-14	72		77	
15-29	71		73	
	Number of years of exposure and number of pregnancies			
	Exp. Yrs.	No. Preg.	Exp. Yrs.	No. Preg.
First Pregnancies	38.8	79	60.8	120
All Later Pregnancies	274.4	260	543.7	481
Years Since Marriage				
0-4	133.7	138	243.1	234
5-9	82.2	80	175.2	152
10-14	38.7	28	80.2	62
15-29	19.8	14	45.3	33

Table 7. Pregnancy rates for Negro domestic workers and those for all other Negroes, when no contraception was used.

those of other Negroes (Table 7) and of white women in Spartanburg. When amenorrheic exposure and pregnancies were included, the rates for the Negro domestic workers were slightly but not significantly higher than those for other Negroes and significantly higher than those for the white women. The rates for the Negroes who were not domestic workers were slightly but significantly higher than the rates for the Spartanburg white women. When amenorrheic exposure and pregnancies were excluded, however, the rates of the Negroes who were not domestic workers did not differ significantly from those for the white women, but the rates for Negro domestic workers remained significantly higher than those for the white women from the same areas. The data are insufficient for any definite conclusions, but they suggest that nutrition may play a part in fertility.

Summary and Conclusions

Recent studies have shown that group differences in uncontrolled fertility are so small as to be negligible. There are, however, individual differences within groups which may be traced to the differential prevalence of certain physiological and pathological factors.

A study of the uncontrolled fertility of a group of white women in Cincinnati, Ohio, and a group of white and one of Negro women in Spartanburg, South Carolina, yielded the following results:

1. It has been shown in previous publications that the pregnancy rates for the exposure without contraception for women who had pelvic and/or endocrine pathology were significantly lower than those for women with no demonstrable pathology.

2. Differences in the length of periods of amenorrhea associated with lactation were responsible for significant differences in the noncontraceptive rates for selected groups of women.

3. It is possible that nutritional deficiency may effect some reduction in fertility.

MEDICAL EVALUATION OF NUTRITIONAL STATUS

I. METHODS USED IN A SURVEY OF HIGH SCHOOL STUDENTS[1]

H. D. KRUSE, C. E. PALMER, W. SCHMIDT, AND DOROTHY G. WIEHL

INTRODUCTION

CURRENT mortality and morbidity records alone constitute unquestionable evidence that a significant nutrition problem exists in the United States today in the form of clinically diagnosable specific deficiency diseases. To cite an important example, nearly 4,000 deaths from pellagra were registered in 1938, and estimates of 100,000 active cases during the same year have been made. Reports from hospitals and other sources suggest that other specific nutritional diseases are prevalent in the general population, though they contribute few annual fatalities. Less well-defined cases of gross inanition and even starvation also appear in medical practice. The prevalence and incidence of such marked deficiency conditions are not known, however, since no system for reporting cases is in operation in the United States. Furthermore, even the number of deaths from or with these conditions is inadequately indicated in present tabulations of mortality data, due in part to preferential selection of other causes of death. Nevertheless, taken altogether, evidence tantamount to proof may be assembled to show that severe disorders of nutrition occur in a manifest form diagnosable by well-known methods of clinical medicine.

Evidence has accumulated during recent years which indicates

[1] This paper is the first of a series from a cooperative investigation by the Cornell University Medical College, Department of Public Health and Preventive Medicine and Department of Pediatrics; the Milbank Memorial Fund; the New York City Department of Health, and the United States Public Health Service, Division of Public Health Methods. The following representatives of these organizations form a General Committee: Frank G. Boudreau, H. D. Kruse*, Samuel Z. Levine, Carroll E. Palmer*, George T. Palmer*, Thomas Parran, George St.J. Perrott, William Schmidt*, Wilson G. Smillie, and Dorothy G. Wiehl*. Members of the General Committee whose names are followed by an asterisk constitute the Directing Committee. Authors of this report are listed in alphabetical order.

The cooperating agencies have been assisted in carrying out this investigation by the Work Projects Administration for the City of New York, Official Project No. 65-1-97-21, W.P. 24, "Medical Evaluation of Nutritional Status."

that the nutrition problem cannot be limited to a consideration only of persons affected manifestly with the specific nutritional diseases. This evidence is derived mainly from dietary surveys of the food consumption of families and from application of newer diagnostic methods for the detection of the mild states of the specific nutritional diseases. The latter has been restricted mainly to use of a single test for one deficiency in a limited group. Yet data from these sources strongly support the belief that nutritional disturbances less severe than the known manifest deficiency diseases are numerous in the population.

At present the nutrition problem is not satisfactorily defined. For appraisal of nutritional status on a mass scale, dietary surveys, physicians' estimates, and anthropometric indexes have been used. These methods have definite limitations; and the data from them while indicating a nutrition problem, do not describe it.

Dietary surveys of food consumption of families have shown that large groups of the population are subsisting on diets which are quantitatively and qualitatively defective in terms of generally accepted standards. Some of the diets actually consumed have even been found to be similar in nutritive content to those which produce disease in both human and animal nutrition experiments. Where the canvass revealed an inferior or inadequate diet, the inference was drawn that the family or individual was being poorly nourished, and that if they were examined by proper methods, some at least would show an unsatisfactory nutritional state. Also, from time to time, studies have indicated the beneficial effects of supplemental foods in the diets of children with the inference that the previous dietary had been inadequate and had led to unsatisfactory nutrition.

From the medical viewpoint, however, it is necessary to suggest certain limitations of the evidence from dietary studies on the existence of subnormal nutritional conditions. First, it is of the greatest importance to emphasize that this evidence is essentially inferen-

tial since nearly all comprehensive dietary investigations have included no simultaneous clinical study of the persons canvassed. Direct and objective proof is lacking, therefore, concerning the presence of impaired nutrition. Secondly, methods of collection necessarily yield data that are approximate. The varying nutritive content of foods makes assignment of precise values difficult; and data must be interpreted in terms of individual requirements which are often only approximately known. Furthermore, it is necessary to recognize that analyses of food consumption in surveys represent estimates of dietary intake for relatively short periods of time. A third important limitation in the approach to the nutrition problem through dietary studies lies in the fact that, while inadequate or defective diets are probably the most common causes of impaired nutrition, there are other important causes.

Some information on the prevalence of unsatisfactory nutrition has been derived also through the use of anthropometric measurements and the physician's estimate of nutritional status. These techniques have the common characteristic that both represent attempts to select, from the medical viewpoint, individuals having a nutritional disturbance. Except for certain recent modifications, the use of anthropometric measurements or indexes is based on the assumption that a deviation in body weight from an arbitrary standard can be interpreted as an objective sign of the presence of a nutritional defect. The use of the physician's estimate is based on a similar line of reasoning, the diagnosis in this case, however, being made by evaluating several signs, such as the amount and firmness of musculature and amount of subcutaneous tissue. The voluminous literature dealing with these techniques contains many attempts to evaluate their usefulness in the study of the nutrition problem. Among these evaluations many criticisms may be found. For example, the anthropometric indexes have been considered untrustworthy because of an inability to demonstrate that deviations from the standard are specific for an impaired nutritional

status. Physicians' estimates have been criticized because the failure of physicians to agree even reasonably well among themselves in the diagnosis of individual cases indicates a lack of criteria which are both specific and objective. Both procedures, although they reveal many malnourished individuals, have serious limitations; hence there is need for further study of methods for appraising nutritional status.

A relatively new concept of the nutrition problem is based on study of the pathogenesis of the specific deficiency diseases. Studies of this type have provided, and are providing, important knowledge of the sequence of bodily changes which take place during the development of the signs and symptoms making up the typical manifestations of these diseases. As is the case with most other disease entities, the earliest morphological and functional changes are often unrecognized by the patient and many are detectable by the physician only through the use of special technical procedures. It must be admitted also that there are undoubtedly many changes occurring early in the deficiency diseases which are not discernible by techniques now available. Despite a general lack of specific diagnostic criteria for detecting these changes, the fact that early indications are below the level of obvious illness has furnished one rational pattern leading to a postulate that there may be large numbers of unrecognized, but medically significant, subclinical cases of the specific deficiency diseases in the general population. These subclinical cases probably constitute an important part of the nutrition problem.

Extensive laboratory research has been carried on in recent years to develop methods for detecting the morphological, functional, and chemical changes which occur in the subclinical stage of deficiency diseases. A number of specific tests have been perfected to the point where they seem ready for trial application to a much wider extent than has been given them in the past.

A study of methods for appraising the nutritional status of ap-

parently well persons was set up on a collaborative basis in 1938 by Cornell University Medical College, the United States Public Health Service, the New York City Department of Health, and the Milbank Memorial Fund. In this were included not only the methods which were already well known, but also these newer diagnostic techniques. It is planned to determine the practicability of these techniques and to study the methods with a view to improving them and establishing how they can be used most effectively. If these various objectives can be realized, it should be possible to select certain tests and procedures for organizing a system of examination which can be adapted to nutrition surveys generally.

The procedures selected for use in the Study included those which seemed at present to have greatest promise for public health methods, that is, methods which would be applicable as part of a school health examination or for special surveys of population groups. However, in their present stage of development, many of the tests themselves need to be studied with reference to the specificity of the reaction for a given dietary deficiency. Moreover, the reliability and sensitivity of the tests must be evaluated. Results of the application of the individual tests also need to be studied carefully to determine the levels or limits which are significant as an index of normal or subnormal nutritive status. For these purposes, as many different kinds of observations as possible are obtained to give evidence of each type of dietary deficiency. It should be emphasized that the battery of tests used in this Study is not necessary or desirable for survey or public health studies. Some are obviously not suited to such work, but, at the present time, the interpretation of test results requires as much relevant data as can be collected.

The first questions to be answered in the present Study are: Which tests give specific, dependable results, and what criteria can be used to grade or evaluate test results? With this information available, it should be possible to furnish objective evidence on

the prevalence of selected nutritional defects in the population surveyed.

It may be anticipated that certain advantages will derive from the extensive operation of a system of examination. First, it should be possible to determine the prevalence, incidence, and the distribution of specific nutritional defects. Such knowledge is essential to raising the nutritional level of the people. With the extensive use of methods of ascertaining the individual's state, the nutrition work now being carried on could be sharply focused on the malnourished. Secondly, a dependable system of examination would permit an evaluation of the educational efforts to promote better dietary practice and to improve the nutritional state. For lack of suitable methods for appraising nutrition, the results of the educational work in nutrition—on which much time and money are being spent—cannot be closely evaluated. Thirdly, a procedure for detecting deviations in nutrition would provide definite information on the extent to which nondietary causes are responsible for an inferior nutritional state, the exact nature of these causes, and the appropriate therapeutic measures to be pursued. Finally, a satisfactory system for appraising nutrition holds the possibility of putting to test the hypothesis that the enervating effects of even the less severe nutritional deficiencies predispose to other serious diseases. The absence of such a system of methods makes it difficult to supplant debate by demonstration on whether, or to what extent, impaired nutrition may play a part as a predisposing factor in diseases.

The Sample

The pupils in Seward Park High School,[3] a public senior high school of New York City, have been the subjects for the initial phase

[3] We wish to express our appreciation to Mr. Robert B. Brodie, Principal of Seward Park High School, whose active interest and cooperation have greatly aided the Study. We are also grateful to Mr. Anthony W. Klein, Administrative Assistant, to Miss Helen H. Mars and Mr. Herbert M. Ross, Chairmen of the Health Education Departments of the School, and to all the pupils who participated as subjects in this Study.

of the study. This school has an enrollment of approximately 6,000 pupils, of both sexes, ranging in age from 12 to 20 years. It is situated in the lower East Side of Manhattan, an area occupied chiefly by low-income white families. The reported weekly income of the families of the first thousand pupils examined was less than $15 for 12 per cent of the families and $40 or more for only 18 per cent. About 25 per cent of the families were either on home relief or work relief. The families are predominantly Jewish and Italian, and a large percentage of the parents is foreign-born. Participation of the pupils is on a voluntary basis, and a signed request of a parent is required before a pupil is admitted for the examination. Approximately 4,000 signed requests have been received, and about 2,500 children will be examined.

The Study has been conducted also at the Fieldston School of the Ethical Culture Schools,[8] a private school with children from families of relatively high income. These examinations will provide test values on a more privileged group for comparison with data from Seward Park High School.

Description of Procedures

The examinations and specific tests applied to each individual are as follows:

- Medical History
- Dietary History
- Physical Examination
- Dental Examination
- Physical Measurements
- Roentgenogram of Hand and Wrist, Elbow and Hip
- Electrocardiogram
- Stethogram
- Adaptometer (Visual Dark Adaptation) Tests
- Snellen Test
- Biomicroscopic Eye Examination with Slit-Lamp
- Capillary Resistance
- Neuromuscular Response to Galvanic Stimuli
- Nerve Accommodation

[8] We wish to express our appreciation to Dr. David Beck, Medical Director of the Fieldston School, for his assistance in arranging for the examinations; to Dr. G. Derwood Baker, Principal; to Mr. Kendall T. Bassett, and to the pupils who participated as subjects in the Study.

Red Blood Cell Count	Ascorbic Acid in Blood Plasma
Red Blood Cells, Volume Per Cent	Calcium, Phosphatase, Phosphorus in Blood Serum
White Blood Cell Count	Hemoglobin in Whole Blood
Differential Count	Qualitative Tests for Albumin and Sugar in Urine
Sedimentation Rate	Serological Tests for Syphilis
Mantoux Test	

Examination Routine. The initial step of the examination is to have ten or twelve pupils of each sex report to separate examination rooms at 8:30 a.m., having omitted breakfast. At this time a blood sample is taken by veni-puncture and a urine specimen is obtained. The pupils then are provided with breakfast by the Study.

The pupils are called into the physician's room one at a time. In this, as in all other procedures of the Study, considerable emphasis has been placed upon the avoidance of a mass line-up of pupils. The sense of privacy thus engendered, and the personal, confidential relationship established are believed to have played an important rôle in the development of the affirmative response to the Study manifested by the majority of the pupils. All handling of the blood specimen is screened from the pupil's view.

During the remainder of the morning the pupils return by appointment in groups of six (three to each of the examining rooms) during each of the first four school periods. The study periods are chosen for this appointment, so that the pupils may attend all of their subject classes during the morning. During these periods the medical history, physical examination, anthropometric measurements, and Mantoux test are completed.

At the conclusion of this part of the examination the pupils return to their classes, having been informed of their next appointment for the remaining test procedures. These are arranged to follow two days later except for the groups first examined on Thursdays and Fridays, who receive their second series of tests the follow-

ing Tuesday and Monday, respectively. These procedures comprise the physiological tests, the dental examination, diet interview, and Mantoux reading.

Medical History. The medical history provides a record of the pupil's personal and family history of illness, a record of his recent medical care, and some information about his rest, activity, and appetite. The history is secured in a personal interview by a clerk who has been trained to follow precisely a prescribed schedule of questions. The clerks are required to treat the information as confidential, and under no circumstances to venture an opinion or comment on any medical question. Any question that the pupil may have is referred to the physician or nurse. The clerks are taught to cultivate a friendly attitude and to avoid the appearance of formal, routine questioning, but to prevent the inquiry from becoming intimate and "chatty." The questions are asked exactly in the form given in prepared instructions. No additional or supplementary questions may be asked, but any additional information volunteered by the pupil is entered briefly in a space provided on the schedule (Fig. 1).[4] If, upon review, it appears that supplementary information is required, the schedule is referred back to the physician for necessary amplification.

The medical history given by the pupil is supplemented by information obtained from a parent (usually the mother) who is interviewed in the home (*see* Fig. 3). Illnesses of the pupil during the previous twelve-month period are recorded and, for a specific list of diseases, a history of attack is obtained. For parents and siblings of the pupil, the record includes deaths by cause and age at death, history of a selected list of diseases, and present illness from a chronic condition.

Diet History. The diet history in the present Study is designed to provide data which will assist in assigning etiology to nutritional deficiencies suggested by any of the special tests. While the indi-

[4] All the schedules are presented at the end of this paper.

vidual's state of nutrition does not depend solely upon his diet, it is usually of major importance. It is, therefore, desirable to have information that indicates fairly accurately the dietary habits and level of food consumption of the individual. The diet histories will be reviewed together with the individual histories and clinical records for the purpose of interpreting the test results. Thus, the diet history in this Study serves a purpose different from that of dietary surveys planned to yield data from which deductions are to be made concerning the nutrition of the people who consumed the diets.

It was necessary to select methods for collecting diet histories which would be appropriate and feasible for this type of survey. Individual histories were considered to be essential, since the child attending high school usually eats lunch away from home and, also, as McHenry (1) has shown, individuals do not share equally in the family food supply. Furthermore, the methods employed had to be practicable for the study of a large group. This meant that the time and expense involved in the collection and analysis of data should be kept at a minimum and that the procedure should be applicable to every case.

The most accurate technique, and perhaps the only completely accurate method for measuring food consumed by an individual, depends upon a careful weighing of all food offered and all rejected by the subject. Such a technique, eminently suited to research on a metabolism ward and practicable in an institution, is unsuited to field survey work. Many studies of family food consumption have utilized various methods of weighing foods and have demonstrated that such a technique is feasible, though expensive, in families selected on the basis of a willingness to cooperate with the investigator. In the recent study reported on by McHenry, the food used by each individual in the family was weighed by the investigator, who had to be in the home most of the time for the week for which a record was taken. The many investigations of food consumption by families which have been conducted by the United States Depart-

ment of Agriculture during the past twenty-five years usually have been made by taking an inventory by weight of food on hand at the beginning and end of a period and obtaining a day-by-day record of the food purchased or otherwise obtained. This method requires frequent visits to the home by a trained investigator who usually collects records for three or four families per week. Methods of obtaining weighed amounts were considered unsuited to the present Study in which more than one hundred records were to be collected each week.

The second general method of collecting diet records has been that of obtaining a record of weekly purchases, usually by interview with the housewife. Various modifications of the method have been used, especially an account book of purchases kept by the housewife. The information obtained is less accurate and the data on food consumption are estimates.

For the present Study three separate methods, all involving the interview method, were employed. First, a record is obtained by a home visitor from the mother or person who prepares the meals; second, a diet history is taken from the child who is interviewed at the Study Clinic. Each of these records is for two days and the time of the interviews is arranged so that the records are for different two-day periods, except for a small sample of pupils for whom the two records were obtained at the same time to obtain comparative data. A third record has been obtained by having pupils fill out a schedule of questions concerning the food eaten on the previous day. This schedule (Fig. 2) is given to a group to prepare as a classroom exercise. It has been collected only from a sample of the total group examined, primarily for the purpose of evaluating the procedure itself.

The record obtained in the home (Fig. 3) is an itemized statement of foods used by the family at each meal during a two-day period. Each food is described, and homemade dishes prepared from several foods are described in detail and the recipe recorded.

The method is similar to that described by Wiehl and Palmer (2). Quantities used of each food are entered on the schedule after careful questioning. Wherever possible, units of weight or volume are obtained, as pounds or quarts, but household measures, such as measuring cups, tablespoons, etc., also are used. Packaged and canned goods are identified by brand and price, and volume is obtained from the label, either in the home or by visiting a neighborhood store.

Quantity consumed by the pupil, which of course is included in the family quantity, is also entered separately on the family diet record. For each food served at a meal, inquiry is made as to whether the child ate a share of it. A description of the amount eaten by the child is entered, as two rolls, one chop; or an estimate of the share is obtained, as one-sixth of a pie, a heaping saucedish. Inquiry is also made for foods eaten between meals by the pupil and by other family members.

The home-visit schedule provides also for information bearing on social and economic ratings, health history of the family, certain features of the child's behavior and habits, and past history of illnesses.

On the diet history taken from the pupil (Fig. 4), the interviewer lists all foods eaten in the two days preceding the interview. Since the pupil may be expected to find it difficult to give a definite idea of the size of servings, or quantities consumed, moulages[8] of measured quantities of certain items of food are displayed on the interviewers' desks, and typical cups, dishes, and bowls are also at hand. These are used as standards of reference and the pupil is asked to estimate the amounts of different foods consumed in relation to some one of the sample servings or dishes. The pupil is questioned carefully and encouraged to state whether the quantity was more or less, and how much more or less than one of the samples selected

[8] These models were prepared by Miss E. Lipman for the Department of Public Health, Cornell University Medical College.

for comparison. In addition to the dietary information, the pupil is asked questions relative to his food habits and activity, including school and home work or recreation.

Physical Examination. The usual items of a complete physical examination are covered, together with certain observations on development. The items are indicated in detail in the record form (Fig. 5). The examination is made with the pupil recumbent upon a flat examining table. Twelve to fifteen minutes are allotted for each examination. It should be emphasized that none of this time is required for the history, which has been separately obtained. The items specified to be observed routinely have been carefully selected and thereby the number has been kept within feasible limits, at the same time without restricting the physician's descriptive notes when these are indicated. By dictating his observations to a clerk, the physician is relieved of the necessity of recording them. Moreover, certain steps of the examination which often require the time of a physician in routine school health practice, are performed by others so that all of the physician's time may be put upon essential medical diagnostic observations. Thus, height and weight, together with other measurements, are made by technicians. Examination of the teeth is performed by a dentist. Tests of visual acuity are performed in conjunction with the adaptometer tests.

Dental Examination. A complete dental examination furnishes the basis for estimates of dental status in the study of its relationship to nutrition. The examination is made by a dentist using dental mirror and explorer. Present caries, fillings or evidence of past caries, together with the number of surfaces involved, are noted for each tooth; missing permanent teeth are likewise noted. The dentist also observes and notes abnormal conditions of the tongue, palate, buccal and labial mucosa, and gums. These findings are recorded in code on the dental examination schedule (Fig. 6). The code technique, which is that employed in the Child Hygiene Studies of the United States Public Health Service (3), effects considerable econ-

omy in time and effort, leaving the full time of the dentist for dental examinations *per se*.

Anthropometric Measurements. This procedure provides information for estimating physical development by means of a series of measurements of the various lengths, diameters, and girths of the body. The measurements necessary for the computation of some of the "indices of nutrition" are included in the series so that their significance may be examined.

The measurements are made by technicians, with the subjects stripped to underclothing. Paper slippers are provided so that shoes and socks may be removed. The measurements always are made in the sequence shown in the record form (Fig. 7), which facilitates the work by permitting the technician to use each instrument in a definite order and to become proficient in a specific series of steps. Detailed instructions, on the basis of which the technicians are trained, specify the methods of locating the bony points between which the measurements are made, the exact mode of use of each instrument, the position of measurer and subject, and the method of reading and recording each measurement.

Roentgenograms of Bones. The extensive investigations of Todd (4) have revealed the importance of appraisal of skeletal structure in any estimate of developmental status. Moreover, Todd (5) and others have indicated that disturbances in mineral metabolism may be reflected in the degree of calcification apparent in the structure of bones as revealed by roentgenograms. Possible, in addition, are observations on the state of the soft tissues (tela subcutanea) and muscles, and on the presence or absence of pathology in the bones.

In the present study of adolescents, roentgenograms are obtained of the hand and wrist, elbow, and hip. For the radiograms of the hand and wrist, sufficient penetration is used to bring out the bone detail so as to show the density of the bone and the anatomical features indicating the degree of maturation. In order to obtain maximum detail, exposure-holder technique is used with Eastman

No-Screen film. The radiogram of the left-elbow region is used chiefly for the estimation of muscular size and density, subcutaneous tissue and skin. Less attention is given to the bone detail of this region. Here the exposure-holder technique with No-Screen film is also used.

The radiogram of the right iliac crest is made in such a way that the iliac epiphysis is clearly shown, as well as the sacro-iliac joint, the acetabulum, the head of the femur, and the symphysis pubis. The position of the pupil is adjusted so that the central ray of the tube passes through a point midway between the symphysis pubis and the anterior-superior spine of the ilium. The radiogram is taken with Eastman ultra-speed film in cassettes with Patterson "hi-speed" screens, and a Potter-Bucky diaphragm with a speed factor of 4X.

Electrocardiograms and Stethograms. For observations on the heart, the instrument used—the Sanborn Stetho-Cardiette—is a convenient self-contained electrocardiographic apparatus combined with a stethograph designed for the recording of heart sounds. Electrocardiograms in the traditional four leads are recorded at a film speed of 25 mm. per second. Four stethograms are taken, each simultaneously recorded with the second lead electrocardiogram at a film speed of 75 mm. per second. Electrocardiographic tracings first are made with leads I, II, III, and IV, consecutively. Then, with the microphone of the stethograph placed over the mitral area of the precordium, the mitral area sound-track is recorded, together with a simultaneous record of the lead II electrocardiogram. Sound tracings next are recorded from the tricuspid, aortic, and pulmonic areas, with the electrocardiographic lead constant.

The cardiometric test is done in a sound-insulated booth with double doors and with walls, floor, and ceiling of Celotex 8 inches thick. The inside dimensions of the booth are 5x5x6 ft. An adjustable field-type of dental chair is used for seating the subject in a semi-recumbent position. An electric fan in the booth permits ventilation between tests.

These electrocardiograms and heart-sound tracings amplify the findings from the physical examination and, in addition, provide evidence of cardiovascular changes occurring in association with nutritional disturbances, such as vitamin B_1 deficiency (6, 7).

Dark Adaptation. Clinical reports of nyctalopia as a prominent symptom of avitaminosis A (8-12) and demonstration of the relation between the regeneration of visual purple and vitamin A (13) have led to the development of tests for visual dark adaptation. A number of instruments have been used to test either the speed of dark adaptation, the threshold of the dark-adapted eye, or both. Of some of these procedures there has been considerable criticism, based principally upon instrumental factors.

In the present Study, the adaptometer designed by Hecht and Shlaer and the instrument developed by Feldman are employed.

The Hecht and Shlaer adaptometer is a device for exposing the eye of the subject to a standard light of known intensity for a specified time and for measuring the subsequent adaptation of that eye in a dark field by determining its threshold of perception of light stimuli of measured intensity and standard duration at measured intervals of time. The description of the instrument, its calibration, and a recommended procedure are already recorded (14). The procedure of the test, as described by Hecht (15), has been followed with certain modifications in details which will be reported in a later publication when data are presented. A dark room, which houses the instrument and allows subjects to enter and leave without introducing any stray light, was specially designed and built for the present Study.

The small instrument designed by Feldman (16) is intended to serve as a qualitative "screen" for dark adaptation. This test is based upon measurement of the time required for perception of light of fixed intensity after preliminary light adaptation. The procedure recommended by Feldman (17) has been followed.

Visual Acuity. Every subject of the dark adaptation tests receives a test of visual acuity with the customary Snellen test types, placed in an illuminating box provided with 130 watts side illumination. The purpose of this procedure is to identify pupils with marked impairment of visual acuity so that their adaptometer results may be separately considered.

Biomicroscopic Eye Examination. Since the recent demonstration (18) that ocular changes were among the early, constant, and characteristic signs of ariboflavinosis, we have conducted an examination of the eyes by a biomicroscope under slit-lamp illumination. This examination is directed particularly towards detecting vascular proliferation from the limbic plexus, corneal invasion, and iritic involvement—incipient processes in the eye pathology of ariboflavinosis.

Capillary Resistance. In 1889 capillary fragility in association with purpura (19) was reported by Koch, and further observations on such vascular impairment were subsequently described for a variety of pathological states, among them scarlet fever (20), blood dyscrasias (21, 22), and subacute bacterial endocarditis (23). In 1914 Hess described tests showing impaired capillary resistance in scorbutic infants (24). These tests of capillary resistance were of a qualitative character, serving to identify individuals with a markedly abnormal condition of the capillaries. However, in 1927 Frontali (25), using a method depending upon the application of suction, reported detailed studies in which he recorded the petechial count and the appearance of suffusion at levels of negative pressure ranging from −5 cm. to −30 cm. in normal subjects and in those with various pathological conditions. He did not, however, study the test with reference to vitamin C undernutrition. The apparatus of Dalldorf (26), which has been used in some recent investigations, has the disadvantage of requiring the desired level of negative pressure to be reached by gradual increments after the application of the suction cup. This disadvantage is obviated in the instrument

devised by Cutter and Johnson (27), a simple modification of which was described by Schultz (28).

The apparatus used in the present Study was patterned after the Schultz model with some modifications. It permits the simultaneous application to both arms of a partial vacuum of any degree up to –50 cm. of mercury. Both the onset and offset are immediate so that application of a predetermined level of negative pressure may be made for a precisely measured period of time. The test area selected is that centering about the fold of the elbow, extending about 2 inches above and 1 inch below the fold. Six levels of negative pressure have been used: –5 cm., –10 cm., –20 cm., –30 cm., –40 cm., and –50 cm. of mercury. At each level the negative pressure is applied through special cups simultaneously to corresponding loci on each arm for 90 seconds. The reaction at each level of negative pressure is graded by a count of the number of petechiae and by an estimate of the area and intensity of suffusion. The procedure itself may be studied by means of comparisons between the two arms, and by the relationship of the test results at progressive levels of suction. Further details concerning the apparatus, procedure, and criteria, will be given in a later paper in conjunction with observed data.

Neuromuscular Response to Galvanic Stimuli. Since the classic observations of Erb (29), tests of the neuromuscular response to galvanic stimulation have been employed in clinical medicine. Although Erb described the application of the test to adults, it soon became limited in its use almost entirely to the diagnosis of tetany in infants. Thresholds of normal children with relation to age were determined by Holmes for children between one and 13 years old (30).

The stimulating apparatus designed specially for the present Study permits the application of make and break shocks up to 5 milliamperes in tenths of a milliampere. The break-shock circuit is designed to permit a presetting at the desired level of intensity to furnish a rapidly rising curve of current which cuts off at once upon

reaching the preset level. With older stimulating instruments, closing stimuli with resulting contractions were unavoidable before obtaining effective opening stimuli. And since the threshold for opening stimuli is usually higher than for closing, to obtain an opening stimulus which would produce a contraction necessitated a preceding closing stimulus of equal intensity but so far above the closing threshold that an unpleasant or even painful contraction sometimes occurred. With the present instrument this is obviated. The apparatus also provides a condenser discharge stimulus used in the preliminary procedure of locating the motor point.

In the present Study the procedure for determining the threshold of neuromuscular response to galvanic stimulation includes the applications of "make" (closing) and "break" (opening) galvanic stimuli to the ulnar motor points to obtain measurements of threshold. Since it appeared desirable to study the most suitable means of defining threshold, three levels are determined: (1) the first visible muscular twitch; (2) the visible twitch of a finger; and (3) the visible twitch of the entire hand.

The apparatus, procedure, and criteria will be described in detail in a later paper in conjunction with observed data. The use of this test in the large series of adolescents now being examined will make available values in this age group. Chiefly, however, the test is being studied in order to ascertain its usefulness in detecting nutritive disturbances involving calcium or vitamin D, or both. Moreover, the possible relationship of heightened neuromuscular irritability and vitamin B undernutrition remains to be explored.

Nerve Accommodation. When a current is applied to a nerve for a very short time the threshold of excitation is constant. It may be measured with a "make" stimulus of a galvanic current of instantaneous rise. When the current lasts for a relatively long period of time, the threshold is not constant but rises gradually. This change of threshold is known as accommodation, and is characterized by a time-constant λ (31).

The time-constant of accommodation may be determined in several ways (32). A method described by Solandt (33) has recently been added to the series of procedures in the Study. This depends upon a measurement of threshold for a rectangular galvanic shock, followed by a series of measurements of thresholds for exponentially rising currents with greater and greater time-constants of rise. This series is obtained by the introduction of a condenser and variable resistances in the stimulating circuit.

The time-constant of accommodation has been shown to vary over a wide range, independently of the phenomena of "excitation," as a result, among other things, of changes in the calcium-ion concentration in the tissue fluid.

Hematological Procedures. Erythrocyte count, erythrocyte volume per cent, and hemoglobin determinations, leukocyte count, differential leukocyte count, and sedimentation rate comprise the values sought in this group of procedures. The pipettes and chambers used were calibrated by the Bureau of Standards.

The technique of the erythrocyte count follows standard procedure. Trenner pipettes diluting 1 to 200 and Levy counting chambers with improved Neubauer double-ruling are used. The blood specimen is thoroughly mixed in its vial, and each of two pipettes is filled with Hayem's solution as diluent. The one pipette is shaken for 60 seconds in a Hausser shaker just before being used to charge each of the two ruled areas of one chamber. The other pipette is similarly treated and used to charge the two ruled areas of the second counting chamber. Thus, four ruled areas are prepared for counting. Cells in five groups of 16 of the smallest squares, or in a total of 80 small squares (0.02 c.mm. of diluted blood), are counted on each ruled area. The cumulative total as read from a tally counter is recorded by the technicians for each of the five groups of squares. In the first thousand samples, the technician in charge of the hematological unit checked the accuracy of the other technicians' enumerations by counting the cells on one chamber of each of their

preparations. Subsequently the technician in charge has carried out daily at least one such count of one chamber on one preparation of each technician and also the preparation and count of an independent subsample of at least one other specimen of each technician.

In later stages of the work, the euscope (34) has been used for the purpose of making an objective record of red blood cell determinations. This instrument affords a simple mechanism for making a photograph, measuring 4 by 5 inches on bromide paper, of part of the ruled area. Preparation of the blood for counting followed the same procedure as described above, but the actual counts were made and checked from the photographs.

The volume per cent of packed red blood cells is determined by hematocrit according to the method of Wintrobe (35).

The hemoglobin determination is based upon the colorimetric determination of oxyhemoglobin by the Evelyn method, using the photoelectric colorimeter (36). The K_2 value used in calculating the results from galvanometer reading was determined by standardization of the instrument against bloods of various hemoglobin concentration as determined by their oxygen capacity (37, 38).

From the three observed values—erythrocyte count, erythrocyte volume percentage, and hemoglobin concentration—three others are derived by computation: the mean red cell volume, the mean hemoglobin concentration per 100 cc. of erythrocytes, and the mean hemoglobin content per erythrocyte (39, 40, 41).

The first three procedures have long been used in the detection of anemias, among which is the microcytic hypochromic variety, associated with deficiency or disturbance in iron.

The method for making the blood leukocyte count parallels in detail the procedure for the erythrocyte count. Trenner pipettes, having a capillary volume-bulb volume ratio of 1 to 20, and Levy counting chambers with improved Neubauer double-ruling, are employed. Acetic acid, 1 per cent, is used as diluent. Cells falling within the four large corner squares (0.4 c.mm. of the diluted

blood) are enumerated on each ruled area. Both ruled areas on two chambers are used and each chamber is filled from a separate pipette.

The sedimentation rate is determined by Wintrobe's method (42, 43).

Chemical Determinations. During the initial phase of the Study, four blood chemical determinations have been carried out, but it is anticipated that one or more other determinations will be included in the series subsequently. The four values determined have been ascorbic acid concentration in plasma, calcium, phosphorus, and phosphatase in serum.

Vitamin C. Data bearing on the state of vitamin C nutrition as revealed by chemical determination may be obtained by four chief approaches. These are the single fasting blood plasma ascorbic acid determination (44, 45), the urinary excretion of ascorbic acid (46, 47, 48), and, following a test dose, the determination of absorption of ascorbic acid from the blood (49) or excretion in the urine (50). These approaches, which have been reviewed (51), yield information of different character. For the initial survey of a large group the first approach, that of a single determination of the fasting plasma ascorbic acid level, was chosen.

A number of chemical methods for determination of ascorbic acid in the blood have become available, chief among them being the titration method (52) and the photoelectric colorimeter method (53), both based upon the reduction of 2:6 dichlorophenol-indophenol (54). The blood plasma ascorbic acid was determined by titration for the first approximately 1,000 pupils studied. In the study of the second group of approximately 1,000 pupils, the photoelectric colorimeter method is routinely employed. Our procedure in the titration method has followed that of Farmer and Abt, but a macro sample has been used for routine determinations. We have, however, carried out titrations with the micro method on a smaller series. These comparative results, together with parallel determina-

tions by titration and by means of the photoelectric colorimeter, will be reported in a subsequent article.

Calcium, Phosphorus, and Phosphatase. Determinations of serum calcium are being conducted according to the method of Clark and Collip (55).

For the first 1,000 pupils studied, the serum phosphorus and phosphatase concentrations were determined according to the method of Bodansky (56, 57). In the study of the second group of approximately 1,000 pupils, the incubation procedure in the phosphatase determination is being conducted by Bodansky's method, but the color development on both the serum phosphorus and phosphatase determinations is being conducted by the method of Fiske and Subbarow (58).

The calcium, phosphorus, and phosphatase concentrations in the serum undergo changes from deficiency or metabolic disturbances of these substances, representing impairments in nutrition.

Urine Analyses. Urines have been examined qualitatively for albumin and glucose by Boston's modification of the Roberts' ring test and by Benedict's method (59, 60), respectively.

Serological Tests. The first thousand samples of blood were examined routinely by each of the following serological methods (61): Kline exclusion, Kline diagnostic, Kolmer complement fixation, and Eagle flocculation.[6] Exceptionally, in cases with equivocal results, the Kahn standard precipitation test was also conducted. In the subsequent series of samples, the Eagle method has been used only occasionally, the examination scheme otherwise remaining the same.

Summary

A series of observations bearing upon nutritional appraisal and possible etiological factors in malnutrition is being made upon a large group of adolescent high school pupils. These observations

[6] The serological tests for syphilis are conducted through the courtesy of the United States Public Health Service Laboratory, Marine Hospital, Staten Island.

depend upon methods some of which are but recently developed, while none have seen extensive application in public health nutritional surveys. The organization, aims, methods, and procedures of this Study have been presented. The results of the several phases of the investigation will be the subject of subsequent reports.

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COOPERATIVE NUTRITION STUDY

PUPIL'S NO. _____
OFF. CLASS _____
H.E. CLASS _____

Medical History

Name _____ Date _____ Time _____

I. Family Medical History Recorder _____

Disease or Condition	A	B		Last Medical Visit C	D	E
	None	Name of Relative	Relationship to Pupil	Date	Agency	Present Status
1. Tuberculosis						
2. Heart Disease						
3. Diabetes						
4. Undernutrition						
5. Obesity						

II. Parents' Body Type

Parent	Stout	N	Thin	Taller	N	Shorter
Mother	___	___	___	___	___	___
Father	___	___	___	___	___	___

III. Pupil's History Date of Birth _____

A. Illness today _____

B. Illness 7 consec. days or longer in past 12 mos. _____

C. Other severe or freq. recurring illness during past year _____

D. Hospitalization and Medical Care in past 12 months:

Agency	None	Name	Address	Reason for which care sought
1. Hospital				
2. Priv. doctor				
3. Clinic				
4. Priv. dentist				
5. Dent. clinic				

E. Obesity / Undernutrition) or Duration ____ Yrs. Date recognized _____

Fig. 1. Record form for medical history.

-2-

Name _____ PUPIL'S NO. _____
OFF. CLASS _____
H.E. CLASS _____

IV. Handicapping Disease

	No	Yes		No	Yes
A. Heart Disease			H. Other Chronic Disease		
B. Rheumatism			I. Loss of leg, arm, or other part.		
C. Chorea			J. Crippled, paralyzed		
D. Epileptic Attacks			K. Hernia		
E. Asthma			L. Impaired Hearing		
F. Hay Fever			M. Digestive disorder		
G. Other Allergy			N. Wears glasses		

Disease or Condition	Duration	Present Medical Care	Last Exam.	Remarks	On School Records

V. 1st day last menst. period Month _____ Day _____ Usual duration _____ days

Time of menarche: Age _____ Date _____ Season _____

VI. Rest A. Works ___ Before school ___ hrs. After school ___ hrs. Night ___ hrs.

B. Sleeps in bed alone ___ With others ___ Sleeps well ___ Poorly ___

VII. Eating Habits Meal hours regular _____ Irregular _____

Appetite: Good ___ Fair ___ Poor ___ (Meals bought at school _____
(" " " Restaurant _____
Special diet at present: None ___ (" taken to school _____
Purpose: _____ Type _____

VIII. Other History:

Fig. 1A

PUPIL'S NO. _____
H. E. CLASS _____
OFF. CLASS _____

COOPERATIVE NUTRITION STUDY

Diet Record: Classroom Exercise
Record of All Food Eaten on One Day

Name _____ Date _____ Day _____ In Charge _____

1. List everything eaten yesterday - at meals or between meals.
2. Describe foods, as rye bread, white rolls; canned salmon, baked apple; chocolate cake, white icing
3. Record amount eaten tablespoons, teaspoons cups or glasses number (bananas, etc.) pieces, slices, servings
4. Do not forget cream, sugar butter, olive oil sauce on spaghetti salad dressing, gravy

BREAKFAST		NOON MEAL	
Description of Food	Amount	Description of Food	Amount

NIGHT MEAL		BETWEEN MEALS	
Description of Food	Amount	Food Eaten	Amount

Do you take cod liver oil or other vitamin preparation? _____ Name of preparation and brand _____ Am't. daily _____

Where did you eat lunch yesterday?

If not eaten yesterday, when did you last have the following foods:

Orange or grapefruit, or juice _____

Tomato or juice _____ Egg _____

Butter _____ Cheese _____

Milk to drink _____ Leafy vegetable such as cabbage, spinach _____

Fig. 2. Record form for diet history obtained in school as a classroom exercise. It provides for a record of all food eaten on one day.

Record No. _____

1. Name of Head _____ Address _____

2. Name (s) of Pupil(s) in Seward Pk. (1) (2)

3. Ind. No.	4. Census of Household	5. Sex	6. Rel. to H.H.	7. Age	8. No. of Meals in 2 Days * Home a	Out b	9. Employment Occupation a	Priv. Other b	10. Wages Last Rec'd a	Usual b	Period c	11. Employment Wks. in Past 12 Mos.
1			#									
2												
3												
4												
5												
6												
7												
8												
9												
10												

12. a. Sources of Other Income	b. Am't	c. Period	13. Annual Income (Est.)		14. Housing
Children's Aid - Widow's Pension			Under $750		No. of rooms Gas Elec.
Old Age Assistance			$750 – 999		Heating: Furnace Stoves
Home Relief			$1,000 – 1,249		No. of rooms heated
Priv. Ag. (name)			$1,250 – 1,499		Bath tub, Yes No
N.Y.A.			$1,500 – 1,999		Toilet: Private, Yes No
Relatives			$2,000 – 2,499		
Other			$2,500 or more		Amount paid for rent

FAMILY HISTORY. 15. a. Birthplace: Father _____ Mother _____

b. Father's Fa. _____ Mo. _____ Mother's Fa. _____ Mo. _____

c. National Origin: Fa. _____ Mo. _____

d. Year to U.S.: Fa. _____ Mo. _____ 16. Height: Fa. _____ Mo. _____

Member Dead or History of Disease	17. Deaths Year	Cause of Death	Age	18. History of Diseases – For Living and Dead Persons Tuberc.	Rheumatism	Heart Dis.	Diabetes	Cancer
Father								
Mother								
Child								
Child								
Child								

19. Family member (s) now ill or suffering chronic condition (specify) _____

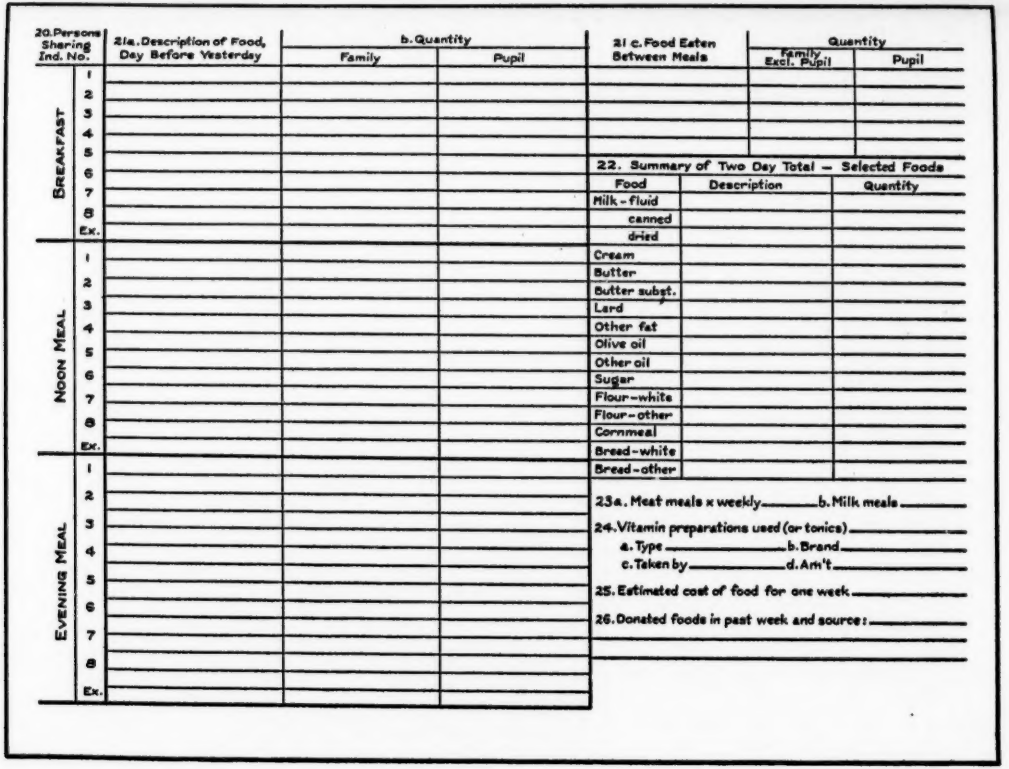
Informant
Date
Visitor

Fig. 3. Record form for data obtained in the home. The schedule provides for a disease history on the pupil and other family members, for income and environmental data, and for a two-day record of foods used by the family and estimates of amounts consumed by the pupil.

20. Persons Sharing Ind. No.		21a. Description of Food Consumed Yesterday	b. Quantity		21c. Food Eaten Between Meals	Quantity	
			Family	Pupil		Family Excl. Pupil	Pupil
Breakfast	1						
	2						
	3						
	4						
	5						
	6						
	7						
	8						
	Ex.						
Noon Meal	1						
	2						
	3						
	4						
	5						
	6						
	7						
	8						
	Ex.						
Evening Meal	1						
	2						
	3						
	4						
	5						
	6						
	7						
	8						
	Ex.						

Fig. 3A

20. Persons Sharing Ind. No.		21a. Description of Food.	b. Quantity		21c. Food Eaten	Quantity	
			Family	Pupil		Family Excl. Pupil	Pupil
Breakfast	1						
	2						
	3						
	4						
	5						
	6						
	7						
	8						
	Ex.						
Noon Meal	1						
	2						
	3						
	4						
	5						
	6						
	7						
	8						
	Ex.						
Evening Meal	1						
	2						
	3						
	4						
	5						
	6						
	7						
	8						
	Ex.						



20. Persons Sharing Ind. No.		21a. Description of Food, Day Before Yesterday	b. Quantity	
			Family	Pupil
Breakfast	1			
	2			
	3			
	4			
	5			
	6			
	7			
	8			
	Ex.			
Noon Meal	1			
	2			
	3			
	4			
	5			
	6			
	7			
	8			
	Ex.			
Evening Meal	1			
	2			
	3			
	4			
	5			
	6			
	7			
	8			
	Ex.			

21 c. Food Eaten Between Meals	Quantity: Family Excl. Pupil	Quantity: Pupil

22. Summary of Two Day Total — Selected Foods

Food	Description	Quantity
Milk - fluid		
canned		
dried		
Cream		
Butter		
Butter subst.		
Lard		
Other fat		
Olive oil		
Other oil		
Sugar		
Flour - white		
Flour - other		
Cornmeal		
Bread - white		
Bread - other		

23a. Meat meals x weekly _____ b. Milk meals _____

24. Vitamin preparations used (or tonics) _____
a. Type _____ b. Brand _____
c. Taken by _____ d. Am't _____

25. Estimated cost of food for one week _____

26. Donated foods in past week and source: _____

Fig. 38

27. DIET HABITS OF CHILD

Appetite: br'kfast____ Eat alone____ With family____

Appetite for lunch____ Eats at home____ Hot L.____

Buys L. at Sch. Caf.____ Other:____ App. Din.____

Eats between meals: daily____ Times weekly____

Food does not eat____

Foods not liked____

Foods liked especially____

Eats meats or fish x weekly____ Eggs____

No. of glasses of milk daily____ Of water____

Citrus fruits x weekly____ Other fresh fruits____

28. HEALTH HABITS

Time to bed____ Arises____ Hrs. sleep usual____

Sleeps in room with____ Bed to self____

Reads in bed____ Radio in sleeping r'm____

Movies: x weekly____ Afternoon____ Eve.____

Games or activities enjoyed____

Am't of exercise____

Fatigues easily____

29. HEALTH HISTORY OF CHILD

a. During past year

(1) Serious illness: Cause____ Month and Duration____ Days in bed____ Phys.____

(2) Serious illness: Cause____ Month and Duration____ Days in bed____ Phys.____

No. of colds____

Growth: Become taller____ More than usual____

Become more stout____ Thinner____ No change____

Weight: Any loss____ Increase____ No change____

b. Disease history (life) Give age of occurrence

Pneumonia____ Rheumatism____ Growing Pains____ Joint Pains____

Scarlet Fev.____ Diphtheria____ Measles____

Whooping C.____ Tonsillitis____ Heart Dis.____

Prolonged or serious illness with or following any of above (explain)____

Other serious illness:____

Fig. 3c

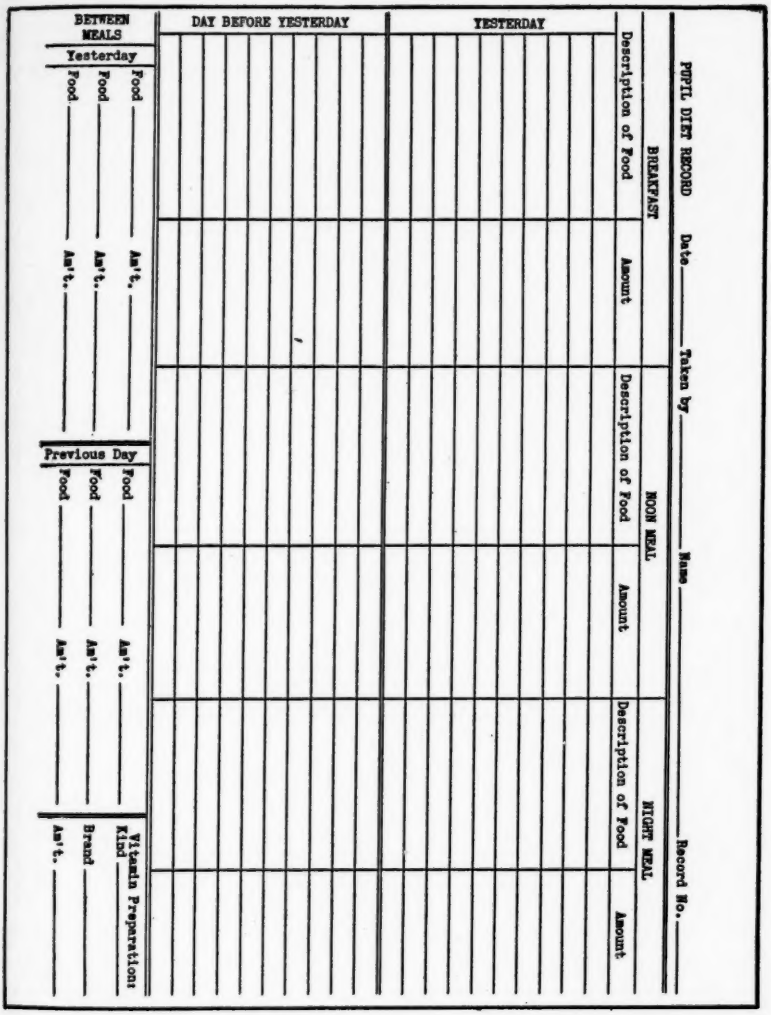


Fig. 4. Record form for diet history from pupil interviewed at Study Clinic. It provides for a record of a pupil's food consumption for a two-day period.

-2-

FOOD HABITS

Yesterday's lunch: Eaten at home____Carried____B'ght.____At school____Free____

Previous day's " : Eaten at home____Carried____B'ght.____At school____Free____

Do you usually eat about the same breakfast?_____

If not, explain_____

Do you usually eat about the same amount of food, as in the past 2 days?_____

_____

Do you drink milk?_____No. of glasses per week_____Eggs per week_____

Kinds of fresh fruit eaten in past 7 days:_____

_____

Vegetables in past 7 days:_____

_____

Vitamin preparation: Kind_____Brand_____Am't._____

ACTIVITIES

Hour arose this A.M.____Yesterday____Hr. to bed last night____Previous____

School exercise periods: Yest._____Prev._____

Outdoors: Yest._____Prev._____

Work or chores: Yest._____Prev._____

Reading or studying: Yest._____Prev._____

Indoors: Movie, etc. Yest._____Prev._____

Other:_____

USUAL ACTIVITIES

School clubs_____

Other clubs_____

Athletics_____

Dancing_____

Movies_____

Other_____

Fig. 4A

COOPERATIVE NUTRITION STUDY

PHYSICAL EXAMINATION

PUPIL'S NO. _____
OFF. CLASS _____
H.E. CLASS _____

Name _____ Date _____ Time _____

Doctor _____ Clerk _____
(Name) (Name)

I. NUTRITION. *Obese: (1. Marked 2. Moderate 3. Appears Normal) Undernourished: (4. Moderate 5. Marked)

*(Distribution of excess subcutaneous fat.)

II. BODY BUILD. 1. Stocky 2. Intermediate 3. Slender Mouth Temperature

___ ___ ___ ___

III. COLOR. (0) Good ___ (1) Slight pallor ___ (2) Moderate to marked pallor ___

IV. SKIN. Acne. (0) None ___ (1) Slight ___ (2) Moderate ___ (3) Marked ___

V. SKIN. Other Lesions: (0) None ___ (1) Present ___

VI. EYES. Lids: (0) Normal ___ (1) Blephoritis ___

VII. " Conjunctivae: (0) Normal ___ (1) Conjunctivitis ___

VIII. " Pupils: (0) Normal ___ (1) Abnormal ___

IX. " Movement: (0) Coordinate ___ (1) Strabismus ___

X. EARS. Right: (0) Normal ___ (1) Purulent Disch. ___ (2) Perf.drum ___ (3) Other ___

XI. " Left: (0) Normal ___ (1) Purulent Disch. ___ (2) Perf.drum ___ (3) Other ___

XII. NOSE. Discharge: (0) None ___ (1) Mucus ___ (2) Pus ___

XIII. " Obstruction: (0) None ___ (1) Partial ___ (2) Complete ___

XIV. " Other Abnormalities: (0) None ___ (1) Present ___

XV. MOUTH. Tongue: (0) Normal ___ (1) Abnormal ___

XVI. " Muc. Membranes: (0) Normal ___ (1) Abnormal ___

Fig. 5. Record form for findings on physical examination.

-2-

Name _____ PUPIL'S NO. _____
OFF. CLASS _____
H.E. CLASS _____

XVII. PHARYNX. Tonsils: (0) Normal ___ Enlarged: (1) Mod. ___ (2) Marked _____
(3) Injected _____ (4) Tonsils out _____

XVIII. " Postnasal discharge: (0) None _____ (1) Mucus _____ (2) Pus _____

XIX. NECK. Thyroid: (0) Normal ___ Enlarged: (1) Slight ___ (2) Mod. ___ (3) Marked ___

XX. " Other Abnormalities: (0) None _____ (1) Present _____

XXI. LYMPH NODES. Enlargement: (0) None ___ (1) Local ___ (2) General ___

XXII. HEART.
Apical impulse: (1) _____ cm. from MSL
Nipple: (2) _____ cm. from MSL
Clavicle: (3) _____ cm.

XXIII. Murmur, syst.: (0) None ___ (1) Base ___ (2) Apex ___ (3) Entire precordium ___
(4) Loud ___ (5) Soft ___ (6) Rough _____

XXIV. Murmur, diast.: (0) None ___ (1) Base ___ (2) Apex ___ (3) Entire precordium ___
(4) Loud ___ (5) Soft ___ (6) Rough _____

XXV. Blood Pressure, syst. _____
" " diast. _____
" " pulse pressure _____

XXVI. Other abnormalities: (0) None _____ (1) Present _____

XXVII. LUNGS. (0) Normal _____ (1) Abn. Findings _____

XXVIII. ABDOMEN. (0) Normal _____ (1) Tenderness, masses _____

XXIX. GENITALIA.
(Males) Discharge: (0) None _____ (1) Present _____

XXX. " Other abnormality: (0) None _____ (1) Present _____

Fig. 5A

-5-

Name _____ OFF. CLASS _____
H.E. CLASS _____
PUPIL'S NO. _____

XXXI. DEVELOPMENT.

Testes in scrotum, Right: (1) Small ____ (2) Medium ____ (3) Large ____

XXXII. " " " Left: (1) Small ____ (2) Medium ____ (3) Large ____

XXXIII. Penis: (1) Small ____ (2) Mod. adolescent ____ (3) Adult ____

XXXIV. Pubic Hair: (0) None ____ (1) Sparse ____ (2) Mod. ____ (3) Abundant (adult) ____

XXXV. Axillary Hair: (0) None ____ (1) Sparse ____ (2) Mod. ____ (3) Abundant (adult) ____

XXXVI. Beard: (0) None ____ (1) Sparse ____ (2) Mod. ____ (3) Abundant (adult) ____

XXXVII. Breasts: (0) No pubertal development ____ (1) Areolar development only ____

(2) Mod. adolescent " ____ (3) Adult development ____

XXXVIII. Gen. appearance of maturity: (0) Pre-adolescent ____ (1) Early adol. ____

(2) Advanced adol. ____ (3) Adult ____

XXXIX. HERNIA. Inguinal right: (0) None ____ (1) Present ____

XL. " " left. (0) None ____ (1) Present ____

XLI. " Other hernia: (0) None ____ (1) Present ____

XLII. EXTREMITY: Part missing (0) None ____ (1) Abnormality, location and description: ____

XLIII. " Part paralyzed: (0) None ____ (1) ____

XLIV. " Deformity: (0) None ____ (1) Description and location ____

XLV. " Other abnormalities: (0) None ____ (1) Present ____

DIAGNOSIS AND RECOMMENDATIONS

No.	Defect or Abnormal Condition	Recommendation

Fig. 5B

-4-

Name_____ PUPIL'S NO._____
OFF. CLASS_____
H.E. CLASS_____

No.	Defect or Abnormal Condition	Recommendations

DESCRIPTION OF ADDITIONAL FINDINGS

XLVI. Median Furrow: (0) Straight_____ (1) Curved_____

(0) Continuous_____ (1) Discontinuous_____

Fig. 5c

Examiner: _____

Name _____ Date _____

School _____ Grade ____ Age ____ Sex ____ Color _____

Toothbrush	Daily _____	Occasionally _____	Never _____
Dentist	Private _____	Clinic _____	None _____
Occlusion	Type I _____	II _____ III _____	IV _____
Gingivitis	Severe _____	Mild _____	Free _____
Care	Degree I _____	II _____ III _____	IV _____

C. Inc.	L. Inc.	Cusp.	1st D.M. 1st Bics	2nd D.M. 2nd Bics	1st Mol.	2nd Mol.	3rd Mol.
Upper Left							
Upper Right							
Lower Left							
Lower Right							
Summary							

Fig. 6. Dental examination schedule on which findings are recorded in code.

COOPERATIVE NUTRITION STUDY

Anthropometric Examination

PUPIL'S NO._____
H.E. CLASS_____
OFF. CLASS_____

Name_____ Date_____ Time_____

Technician_____

1. Hair color: Code No._____ 2. Eye color: Code No._____
3. Biacromial breadth ..... cm._____
4. Axillary chest width..... cm. Rest_____ Max._____ Min._____
5. Greatest chest width..... cm. Rest_____ Max._____ Min._____
6. Hips breadth .....cm._____ 7. Pelvic breadth..... cm._____
8. Chest depth..... cm. Rest_____ Max._____ Min._____
9. Ant.-Post. chest diameter..... cm. Rest_____ Max._____ Min._____
10. Axillary chest girth..... cm. Rest_____ Max._____ Min._____
11. Mamillary chest girth..... cm. Rest_____ Max._____ Min._____
12. Hips girth..... cm._____
13. Thigh girth..... cm. Right_____ Left_____
14. Arm girth, flexed ....cm._____ 15. Arm girth, relaxed...cm._____
16. Subcutaneous tissue..... mm. (a)_____ (b)_____
17. Weight ..... lbs._____
18. Standing height.....cm._____ 19. Sitting height.....cm._____
20. Calf girth, cm. Rt._____ Left_____ 21. Ankle girth, cm. Rt._____ Left_____

Remarks:

Fig. 7. Record form for anthropometric measurements showing sequence of items.

ANNOTATIONS

POPULATION QUESTIONS IN SWEDEN AND ENGLAND

ALTHOUGH the politico-economic culture, and social organization, of which the two books under review are an expression, may soon be as dead as the civilization of early nineteenth century New England, much is to be learned from the authors. Myrdal[1] (a leading Swedish economist long interested in population problems), whose discussion is based largely upon Swedish data and experience, devotes most attention to the probable effects (in a democracy such as the Swedish) of the population decline upon future social policy and upon the attitude of various classes toward social policy. Reddaway[2] (an able young English economist) analyzes in considerable detail the probable effects of English population trends upon the level of employment, the size and distribution of the national income, public finance, and international trade. Although each author, in especial Reddaway, treats both contra-unemployment measures and fertility-fostering policies, full examination of the latter awaits the appearance of D. V. Glass's forthcoming study. The reader is left with the impression that the population trend will soon be the source of the most difficult problems confronting nations, and that no democratic society, dominated by uninformed, unimaginative, huckster-minded politicians, will be able to solve this problem.

Reddaway concludes that the population trend under way in England (i.e., a decline in numbers coupled with the gradual aging of the population), together with consumption and other trends less intimately related to the decline in fertility, will intensify the tendency to both "gen-

[1] Myrdal, Gunnar: POPULATION: A PROBLEM FOR DEMOCRACY. (The Godkin Lectures, 1938). Cambridge, Harvard University Press. 1940. 237 pp. $2.00.

[2] Reddaway, W. B.: THE ECONOMICS OF A DECLINING POPULATION. New York, The Macmillan Company. 1939. 270 pp. $2.50.

eral" (i.e., "depression") and "particular" (i.e., "frictional") unemployment. As the population declines, the need for inter-occupational shifts and adjustments will increase whereas the flexibility of the economic system and its ability to adjust will tend to diminish: consequently the relative amount of "particular" unemployment will tend to increase. "General" unemployment will tend to increase in consequence of the fact that, as population declines, the capacity of the economy to absorb investment probably will not increase in the same proportion as the relative amount of savings conjoined with business risk and uncertainty. These two tendencies to greater unemployment are not inevitable, however, according to Reddaway; for, since the level of employment is a function of many factors, appropriate modifications in the nondemographic factors may countervail, or more than countervail, changes in the demographic factor. While Myrdal's conclusions relative to the purely economic effects of present population trends are in line with Reddaway's, he emphasizes in larger measure that: (a) nations lacking youth and the qualities of youth (courage, initiative, idealism, imagination) will tend to deteriorate; (b) youth will be denied in greater degree than in the past both economic opportunities and a voice in affairs; (c) that an administrative, bureaucratic, and senile State Socialism will replace the dynamic economy that we have known.

Myrdal concludes that in the western world "a stationary population" constitutes "the maximum possibility even with the strongest population policy." Since the marriages that are sterile, or become sterile before two children are produced, comprise one-fifth of all marriages, Sweden can maintain her population only on condition that "the majority of non-sterile marriages . . . produce four children." But in view of the fact that between one-third and one-half of the children now born are not actually desired by the parents, the majority of marriages will not produce four children "unless vast distributional reforms in the interest of families with children are enacted"; and public opinion is "not prepared to accept" such reforms.

Myrdal makes many interesting observations that can but be suggested here. A positive population policy is unthinkable in a peaceful democracy "except on the basis of a kind of psychological identification of the individual with the people." (Obviously such an identification is most difficult to achieve in a nation as ridden with racial, ethnic, religious, and class contradictions as the United States.) The prevailing Christian atti-

tude toward "sex" is not conducive to the solution of the population problem. Persecution has caused both Neo-Malthusianism and New-Malthusian attitudes to flourish. Efforts to drive women out of the labor market will frustrate any populationist policy. In consequence of the growing need for distributive policies suited to preserve the family and foster marriage and natural increase, conservative opposition to economic measures deemed radical in the past is dissolving.

Reddaway and Myrdal are to be criticized chiefly for their failure to consider what must be done to preserve democracy. Each favors this system. Yet each implicitly forecasts that population decline will destroy democracy. It follows, by implication that since a gutless gerontocracy cannot cope with the socio-economic problems that will be precipitated, a virile democracy can be preserved only provided that our political and economic system is modified in such a way as to throw the balance of power to persons under fifty.

J. J. SPENGLER

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PSYCHOLOGICAL FACTORS IN MARITAL HAPPINESS

FEW books are more deserving of attention from students of social science than this well-written report by Terman and his colleagues[1] of their investigation of marital happiness. The metrically-minded psychologists are now rushing into the taboo-infested field of social relationships where previously all but the Freudians, the poets, and an occasional sociologist had feared to tread. In this instance the result has the merits and shortcomings of a pioneering study which demands faith in empirical methods, enthusiasm for measurement, and a deaf ear to the logical cautions of a critical conscience. Perhaps social science would make little advance if now and then an adventurous Pinocchio did not run ahead of his Jiminy Cricket. On the credit side must be recorded the ingenuity of many of the procedures employed in the study, the thoroughness with which the data are handled, the wealth of material concerning the interrelationship of attitudes, the interesting presentation of a mass of quan-

[1] Terman, L. M., *et al:* PSYCHOLOGICAL FACTORS IN MARITAL HAPPINESS. New York, McGraw-Hill Book Company, Inc. 1938. 474 pp. $4.00.

titative material, and the stimulation to workers in this and related fields of social research.

The data of the study come from the responses of 792 husbands and wives to an elaborate questionnaire which sought four types of information about the couples: (1) degree of marital happiness; (2) personality characteristics; (3) background factors; and (4) sexual attitudes and adjustments. An index of marital happiness was devised on the basis of the average amount of agreement between spouses on certain items, communality of interests, subject's own rating of the happiness of his marriage, contemplation of separation or divorce, regret of marriage, number of domestic grievances, and choice of spouse if life could be lived over. The procedure of the study was to compare the scores on this index of happiness with the responses to other questions to discover the correlates of marital harmony.

Personality characteristics of happy wives, according to their own admission, include traits of optimism, kindness, cooperation, thrift, attention to detail, conservatism in religion, morals and politics, and missionary and ministering attitudes. On the other hand, women who admit unhappiness in married life also admit lack of self-confidence, neuroticism, unconventionality and radical views on religious and social matters. Likewise happy husbands, self-admitted, report themselves as stable emotionally, cooperative, somewhat extraverted, methodical, thrifty, and conservative.

When the happiness scale is related to background factors the spouses with high happiness scores report that their parents were happy in their married life, that they had happy childhoods, that they had little conflict with their parents and were strongly attached to them, that home discipline was firm but not harsh, and that their premarital attitude was free from disgust or aversion. Background factors which showed no correlation with the happiness index include income, occupation, presence or absence of children, amount of religious training, birth order, adolescent popularity, and spouse differences in age and schooling.

The sex factors which are associated with high happiness scores are described as husband-wife equality in strength of sex drive, wife's orgasm adequacy, rated degree of satisfaction from intercourse with spouse, low number of sex complaints checked, frequency with which intercourse is refused, and frequency of desire for extramarital intercourse.

In general the authors conclude that happiness in marriage is largely

a function of a happy temperament and that the role of sexual adjustment in marriage has been greatly exaggerated by the sexologists. They are not averse to a genetic or hereditary interpretation because they think that evidence from this and other studies shows that happiness runs in families.

The investigators are open to two important criticisms. In the first place, they do not seem to be fully aware of the shortcomings and possible sources of error in the questionnaire method. They do realize that the halo effect of a happy marriage can color the responses that happy spouses make to other questions, though they discount this halo effect in almost all areas save that of sex. But nowhere do they give adequate recognition to the rationalizing tendency of people in answering evaluative questions, many of which are fairly direct, even when people are assured of the anonymous nature of the questionnaire. Many of the relations reported between happiness scores and the answers to other questions may merely reflect the tendency of some people to check socially approved replies. For example, the individual who claims his marriage is happy may well be the type of person who will also describe himself as cooperative, well-adjusted, and conventional. This does not prove that conventionality is highly correlated with marital happiness because no external criterion of marital happiness is provided. It does prove a general factor of verbal conventionality but we also want to know how closely verbal conventionality is related to conventionality in overt behavior. It is not beyond the bounds of possibility that some of the people who characterize themselves as happily married and as good, kind Sunday-school folk may be as capable of raising their own particular brand of family hell as some of the people who admit they have not married angels, that this is not the best of all possible worlds, and that they are not overburdened with sweetness and light. To what extent this objection vitiates Terman's conclusions it is not possible to say until his predictive scale for marital happiness is validated against some other criterion than self-characterization. The reviewer is merely raising the point that pious talk and acts of piety may not be perfectly correlated.

The second objection to the book is the convenient picking and choosing from the correlations found in the study. Repeatedly the authors object to writers on marriage who offer opinion and not fact. Their own findings they emphasize are factual. Yet they do not follow the facts of their study, but throw them away, when they think associations are

effects and not causes of marital happiness. Their judgment may be right but their conclusions on the relative unimportance of sexual adjustment do not come from their factual findings but from their opinion.

Students of marriage and the family will find the techniques of this study useful in social investigation. The authors have developed *reliable* methods for securing difficult types of data. If their *validity* can be established we will be able to attack some of the most important problems of family relationship.

DANIEL KATZ

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TUBERCULOSIS IN RURAL AREAS

THE importance of systematic and coordinated research on rural tuberculosis is forcefully brought out in an interesting and comprehensive report prepared by Dr. G. Ichok for the Health Organisation of the League of Nations.[1] Preliminary to the preparation of this report the Sub-Committee on Tuberculosis of the Conference of Directors of Institutes and Schools of Hygiene, held at Geneva in 1937, had outlined a program for a survey on Rural Tuberculosis which included a statement of the need for securing and coordinating facts essential for combating the disease.

The first section of the report deals with tuberculosis mortality and presents a comparative study of trends in towns and rural areas in countries of Northern, Western, and Southeastern Europe.[2] In most of the European countries where statistics of deaths were available over a relatively long period of time, the mortality from tuberculosis has been consistently lower in the rural areas than in urban areas; however, the decline in the rates for urban areas or towns began at an earlier period and was more marked. This was noted especially for the period since the World War. As a result, the differences between the level of mortality in rural and in urban areas has been decreasing.

[1] Tuberculosis in Rural Areas. Bulletin of the Health Organisation of the League of Nations, viii, Nos. 4-5, 1939.

[2] European countries included are: Finland, Denmark, Sweden, Norway, Prussia, England and Wales, Scotland, Irish Free State, the Netherlands, France, Switzerland, Hungary, Roumania, Czecho-Slovakia, and Greece.

Consideration of tuberculosis mortality by age and sex indicated that age and sex variations were not constant throughout the different areas examined. Biraud, after study of mortality by age and sex in a large number of countries and towns, found that there were three main types of age curves. The sex differences and age curves were described as follows:

> During the first year of life, there is in every case a higher mortality rate for the male sex than for the female; the difference varies between 20 per cent and 25 per cent, but sometimes reaches as much as 50 per cent or 55 per cent. Next, in the later stages of childhood up to the age of about 12 years, the rate is the same for both sexes and is relatively low. From the age of puberty until 25 years, on the other hand, the mortality rate for females is above that for males both in towns and in rural areas.
>
> The three types of tuberculosis mortality curves which BIRAUD distinguishes emerge clearly after the age of 25. Under type A, the curve reaches its climax for both sexes between the ages of 20 and 30; it then falls slightly and remains constant until about 70 years of age. Type B has a single peak between the ages of 20 and 40—often round about the age of 25—and this peak is followed by a steady decline leading to a low mortality rate towards the end of the adult period and in old age. Finally, type C rises from puberty to the age of 25, and continues to ascend until it reaches its maximum towards the end of adult age and even sometimes in old age—that is, between 70 and 80 years.

In general, the mortality rates were higher for young women in rural areas than in towns; males in the city showed an excess of tuberculosis deaths over those in the country.

The report also discusses morbidity from tuberculosis and the difficulties present in any attempt to gauge the amount of infection in a community. Because of lack of notification of cases, the principal source of information, other than mortality statistics, has been the results of tuberculin testing, chiefly among children. Unsatisfactory as this method is, it has shown wide differences in the amount of infection present in different rural districts. These variations were considered as further evidence of the need for regional surveys in planning a rural tuberculosis program.

The influence of migration from the country to the city was found to be an important factor in tuberculosis control. For example, in a study made in Bucharest, out of 507 persons suffering from pulmonary tuber-

culosis, 61 per cent came from rural districts, and in only 15 per cent of these cases had tuberculosis developed before they had come to the City. There was evidence also that those persons of rural origin were predisposed to bilateral progressive forms of the disease. The results of several other studies tended to confirm the findings of the Roumanian study. Since the migrant from the rural area may also return to the country after he has become infected, he presents a special problem to both rural and urban communities.

Finally, the report discusses bovine tuberculosis, which is chiefly a rural problem because of the consumption of raw milk in rural areas. It is recommended that studies in this field be made taking into account medical and veterinary findings.

According to Biraud: An urban rate which is higher than the rural rate may be due to several causes:

(a) More reliable registration of causes of death in the towns;

(b) Better hospital facilities in the towns, with the result that patients in country districts go there to die. This cause of error only operates when the rates are calculated in accordance with death certificates and when no distinction is made between permanent and casual residence;

(c) The influence of occupational mortality among men when the higher urban rate is due to the mortality among males;

(d) Generally speaking, a marked difference in the mortality rate of both sexes as between urban and rural areas means that the tuberculisation of the rural population is far from complete.

This report is especially important in that it brings together a mass of valuable data, and calls attention to many different aspects of the tuberculosis problem. Furthermore, the report emphasizes various factors which need to be studied and taken into account in planning an antituberculosis program for a rural area.

SALLY PREAS